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VAN TURNHOUT (H. M. T.) & VAN DER LAAN (P. A.). **Control of *Lygus campestris* on carrot seed crops in North Holland.**—*Tijdschr. PlZiekt.* **64** pt. 4 pp. 301–306, 3 figs., 9 refs. Wageningen, 1958. (With a summary in Dutch.)

The following is based on the authors' summary. In a test in July 1957 against *Lygus campestris* (L.) attacking carrot seed crops in Holland, two applications of an atomised spray of 0·75 per cent. DDT, the second made 18 days after the first, when infestation began to increase, gave good control. Dieldrin was less effective. The yield of viable seed was increased from 53 to 89 per cent. by DDT and from 53 to 65 per cent. by dieldrin.

EVENHUIS (H. H.). **Over de invloed van de winter op de parasitering van de appelbloedluis, *Eriosoma lanigerum*, door haar parasiet *Aphelinus mali*.** [The influence of the winter on parasitism of the woolly apple aphid, *E. lanigerum*, by its parasite, *A. mali*.]—*Tijdschr. PlZiekt.* **64** pt. 4 pp. 328–332, 2 graphs, 6 refs. Wageningen, 1958. (With a summary in English.)

The following is based on the author's summary. In Holland, the winter of 1955–56 was severe and that of 1956–57 mild. *Eriosoma lanigerum* (Hsm.), an important pest of apple, is more susceptible to cold than its parasite, *Aphelinus mali* (Hald.) [*cf. R.A.E.*, A **48** 273], and suffered high mortality in February 1956. Survival in the following winter was high, but the ratio of parasites to potential hosts was low in early 1957, so that parasitism in May was much lower than it had been in the previous years. It increased during the summer, however, and reached 68 per cent. in September.

EVENHUIS (H. H.). **De vectoren van het bloemvergroeningsvirus van klaver.** [The vectors of the virus causing phyllody (virescence) in clover flowers.] —*Tijdschr. PlZiekt.* **64** pt. 4 pp. 335–336, 5 refs. Wageningen, 1958. (With a summary in English.)

Four Cicadellids have been recorded as vectors of the virus causing phyllody in clover and other flowers [*cf. R.A.E.*, A **46** 146; **48** 100]. In tests for additional vectors in Holland in 1957, it was transmitted, though not readily, by *Macrosteles cristatus* (Rib.) and *Aphrodes albifrons* (L.), but not by *Philaenus leucophthalmus* (L.) (*spumarius*, auct.) or *Agallia consobrina* Curt. The incubation period in the insects lasted 6–7 weeks.

STAHL (M.) & UMGELTER (H.). **Pflanzenschutz im Blumen- und Zierpflanzenbau.** [Plant protection in the cultivation of flowering and ornamental plants.]—*Handb. Erwerbsgärtners* **5**, 9 × 6¼ in., 371 pp., 235 figs., 4½ pp. refs. Stuttgart, E. Ulmer, 1959. Price *DM.* 25.

This manual on the protection of flowering and ornamental plants (including those grown under glass) from pests and diseases is written with special reference to conditions in western Germany and consists of two main parts. The first comprises a general survey of the importance of the subject, the causes of unthriftiness in plants, methods of determining the causal agent and the ways in which diseases, pests and weeds can be

controlled, with information on insecticides and other chemicals used and on apparatus for their application and a short section on biological control. The second and longer part is concerned first with the individual pests and diseases, some 45 pages being devoted to mites and insects, with notes on their appearance, habits and control, and then includes a list of the plants with detailed discussions of the pests and diseases affecting each. Lists of the German plant protection stations and of references to the general and the more specialised literature are appended.

Bombosch (S.). **Die Ursache eines eigenartigen Blattlaussterbens.** [The cause of unusual mortality of aphids.]—*Z. PflKrankh.* **65** pt. 12 pp. 694–695, 3 figs., 1 ref. Stuttgart, 1958.

High and increasing mortality of *Macrosiphum pisum* (Harris) (*Acyrthosiphon onobrychis* (Boy.)) in mass cultures on pea plants in a greenhouse in Germany during recent summers was found to be the result of attack by the predacious larvae of a Cecidomyiid, *Phaenobremia aphidisuga* (Rübs.). *Myzus* (*Myzodes*) *persicae* (Sulz.) and *Aphis fabae* Scop. were also attacked.

Fritzsche (R.). **Abhängigkeit der Spinnmilbenvermehrung von dem Ernährungszustand der Wirtspflanzen.** [The relation of spider-mite increase to the nutritional status of the food-plants.]—*Tagungsber. dtsch. Akad. Landwirtschaftswiss. Berlin* no. 17 pp. 55–63, 3 graphs. Berlin [?1958]. (With summaries in Russian & English.)

The following is based on the author's summary. Experiments were carried out in Germany in 1955–57 in which *Tetranychus telarius* (L.) (*urticae* Koch) was reared on bean plants (*Phaseolus vulgaris*) growing in sand culture to which nutrient solutions lacking in potassium, phosphorus or nitrogen compounds or containing a sufficiency of all three nutrients were added. The greatest increase in mite numbers occurred on the plants deficient in potassium. Chemical analysis of the leaves showed that mite increases were related to increased content of total nitrogen [*cf. R.A.E.*, A **48** 365], mainly in the form of insoluble compounds, glutamine and glutamic acid, and of reducing sugars. Mite increase varied on different bean varieties, owing to variations in the sugar and nitrogen contents of the leaves.

Meier (W.). **Der Einfluss der Höhenlage und geländeklimatischer Faktoren auf das Auftreten der grünen Pfirsichblattlaus** (*Myzus persicae* **Sulzer**) **in Kartoffelfeldern der Schweiz.** [The influence of altitude and local climate on the occurrence of *M. persicae* in potato fields in Switzerland.]—*Europ. Potato J.* **1** no. 2 pp. 25–46, 4 figs., 7 refs. Wageningen, 1958. (With summaries in French & English.)

The following is based on the author's summary. A survey of potato crops in Switzerland in 1955–57 showed that the dates of the initial infestation and the summer migration by *Myzus persicae* (Sulz.) became later and the numbers of aphids per plant decreased as altitude increased. Plants became infested even at altitudes above 3,000 ft. [*cf. R.A.E.*, A **45** 250], but, in general, slopes and hills exposed to winds in prealpine regions were the most suitable for the production of seed potatoes free from virus infection, though there were local differences.

Sylvén (E.). **Studies on fruit leaf Tortricids (Lepidoptera) with special reference to the periodicity of the adult moths.**—*Medd. Växtskyddsanst.* **11** no. 74 pp. 131–296, 4 col. pls., 64 figs., 4 pp. refs. Stockholm, 1958.

Tortricids of which the larvae do not feed entirely within the fruits but also attack the leaves and flowers of fruit trees often do severe damage, particularly to apple. The author found larvae of 12 species feeding on apple in this way in southern Sweden in 1959, and he discusses their distribution in Sweden and elsewhere, their food-plants and their life-histories. *Ptycholoma* (*Cacoecia*) *lecheana* (L.), *Argyroploce variegana* (Hb.), *Pandemis ribeana* (Hb.), *P. heparana* (Schiff.), *Archippus oporanus* (L.) (*C. podana* (Scop.)) and *Spilonota ocellana* (Schiff.) hibernate as immature larvae, and *Rhopobota* (*Acroclita*) *naevana* (Hb.), *Archips* (*C.*) *rosanus* (L.), *A.* (*C.*) *xylosteana* (L.), *Acleris holmiana* (L.), and *A. rhombana reticulata* (Ström) in the egg stage, and descriptions of all stages of these, with keys, are given. *A. variegana* (Schiff.) was observed only in the adult stage.

The chemical control of these pests is discussed from the literature, and small-scale tests made in 1954–57 are described. Treatment with emulsion sprays containing 1·5 lb. malathion or 0·18 lb. parathion per 100 gal. on 9th and 23rd May (at about the bud-burst and green-cluster stages) controlled the larvae well, and 1–2 similar applications in July and August controlled caged adults of *Archips rosanus* and *S. ocellana*, and also newly hatched larvae of the species that overwinter in the larval stage, and were more effective than DDT, γ BHC (lindane) or the other insecticides tested. In a single test in 1957, 0·6 lb. trichlorphon per 100 gal. was effective against the summer larvae. It is considered that, although spring applications give effective control, reinfestation from adjoining infested areas by species that hibernate in the larval stage would be likely in summer.

Details are given of cage and light-trap experiments on the flight periods of the adults, and it is shown that fluctuations in trap catches are due partly to changes in the adult population and partly to the effect of wind velocity, temperature and possibly rain, but little to variations in relative humidity and air pressure, moonlight or visibility. The numbers of moths caught in different localities are compared, and it is stated that an advisory service to give notification of the times suitable for summer applications against the species hibernating in the larval stage has been established; it is based largely on the seasonal occurrence of *Archippus oporanus* and *Spilonota ocellana*.

Gabriel (W.). **Études sur les vecteurs des maladies à virus de la pomme de terre en Pologne.**—*Parasitica* **14** no. 4 pp. 119–134, 3 graphs, 14 refs. Gembloux, 1958.

Virus Y (mosaic) is more important than the leaf-roll virus on potato in central Poland, and this indicated that *Myzus persicae* (Sulz.) was not the only aphid concerned in transmission. Surveys in 1955–59 showed that the aphids present on potato were *Aphis nasturtii* Kalt. (with which *A. gossypii* Glov. (*frangulae*, auct.) was included), *M. persicae*, *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.) and *M. euphorbiae* (Thos.) (*solanifolii* (Ashm.)), of which the first was much the most numerous and more so than *A. gossypii*. Infestation by these two began in late June, reached its peak about the end of July, and then declined. Statistical evidence indicated that they were the principal vectors of virus Y, and thus of potato viruses as a whole in central Poland. The evidence indicates that their importance as virus vectors in Europe increases and that of *Myzus persicae*

decreases as the climate changes from a maritime one in the west to a continental one in the east.

Szmidt (A.). **Wykorzystanie** *Dahlbominus fuscipennis* **Zett. (Chalcididae, Hym.) do zwalczania boreczników (Diprioninae, Hym.).** [The use of *D. fuliginosus* (Nees) for the control of Diprionine sawflies.]—*Prace Kom. Nauk roln. leśn.* **5** pt. 3, 57 pp., 3 figs., 9 graphs, 44 refs. Poznan, 1959. (With a summary in English.)

The following is based on the author's summary. This paper is concerned with the problem of using a local parasite for pest control and is divided into two main parts. The first consists of an account of the development and ecological requirements of *Dahlbominus fuliginosus* (Nees) (*fuscipennis* (Zett.)) and of a method of rearing this Eulophid in the laboratory. In the second, details are given of investigations in which laboratory-reared stocks were released in experimental forest areas in Poland for the control of pine sawflies (*Diprion pini* (L.), *D. similis* (Htg.) and *Gilpinia frutetorum* (F.)). A method of establishing 'multiple continuous parasite foci' was developed and found capable of preventing sawfly outbreaks, provided that the population density of the host was fairly high and the litter appropriately mixed. The increase in the number of parasites was transitory, however, and control did not persist for any length of time. It is concluded that the method does not give practical results unless the parasite used produces at least one generation of progeny.

Kawecki (Z.). **Studia nad rodzajem** *Lecanium* **Burm. IV. Materiały do monografii misecznika śliwowego,** *Lecanium corni* **Bouché, Marchal (♀nec♂) (Homoptera, Coccoidea, Lecaniidae)...Studies on the genus** *Lecanium* **Burm. IV. Materials to a monograph of the brown scale,** *Lecanium corni* **Bouché, Marchal (♀nec♂) (Homoptera, Coccoidea, Lecaniidae).**—*Ann. Zool.* **17** no. 9 pp. 135–215, 15 pls., 2 figs., 7½ pp. refs. Warsaw, 1958. (With summaries in Russian & English.)

Eulecanium (*Lecanium*) *corni* (Bch.) is an important pest of fruit and other deciduous trees in southern Poland, as in other parts of Europe. Observations, which are recorded, showed that the time of oviposition varied with the food-plant, beginning in mid-May on peach but not until some three weeks later on buckthorn (*Rhamnus*). The nymphs hatch in about a month (the first being observed on 10th June in 1950) and feed on the leaves until October, when they move to the twigs and trunks for hibernation. The second moult occurs in spring, and adult males and females are present soon after. All stages are described, and it is stated that the scale infests about 130 plant species in Poland, including some not previously recorded, and occurs at all elevations up to about 2,800 ft. It has no effective parasites, but is reduced by heavy rain at the time of hatching. Fungi afford some control.

Łęski (R.), Zawadzka (B.) & Szczygieł (A.). **Doświadczenia nad zwalczaniem misecznika śliwowego** (*Lecanium corni* **Bouché) w okresie letnim i zimowym.** [Experiments on the control of *Eulecanium corni* during summer and winter].—*Prace Inst. Sadown.* **3** pp. 30–50, 2 graphs, 21 refs. Warsaw, 1958. (With summaries in Russian & English.)

Experiments on insecticides for use against *Eulecanium* (*Lecanium*) *corni* (Bch.) on fruit trees in Poland showed that little or no control was afforded

by emulsion sprays of 0·4–0·8 per cent. DDT or 0·2–0·4 per cent. BHC applied once at the beginning of hatching, and even two applications, one at the beginning and one at the end of the hatching period, did not give economic control, whereas 90 per cent. kill was afforded by winter sprays of tar distillate, DNC or both.

Suski (Z.). **Wyniki jednorocznych badań nad występowaniem w Polsce roztocza truskawkowego** (*Tarsonemus pallidus* **Banks, Acarina, Tarsonemidae).** [Results of one year's investigations on the occurrence of the cyclamen mite (*Steneotarsonemus pallidus*) in Poland.]—*Prace Inst. Sadown.* **3** pp. 171–176, 1 map, 4 refs. Warsaw, 1958. (With summaries in Russian & English.)

Fears that *Steneotarsonemus* (*Tarsonemus*) *pallidus* (Banks) was present on strawberry in Poland were confirmed by a survey in July–August 1957. The mite was found to be widespread, occurring in 26 of 38 experimental plantings and in all but one of 17 districts in which strawberry is cultivated. It was observed in plantings over five years old and in areas in which imported varieties were not used, so that it had probably been present in the country for several years.

Szweda (M.). **Obserwacje biologiczne i doświadczenia nad zwalczaniem kwieciaka jabłkowca** (*Anthonomus pomorum* **L.) preparatami zawierającymi HCH zastosowanymi po złożeniu jaj.** [Investigations on the control of the apple blossom weevil (*A. pomorum*) with BHC applied after oviposition.]—*Prace Inst. Sadown.* **3** pp. 177–196, 7 graphs, 14 refs. Warsaw, 1958. (With summaries in Russian & English.)

Observations near Warsaw in 1955–56 showed that the adults of *Anthonomus pomorum* (L.) leave their hibernation sites when the maximum day temperature reaches 10°C. [50°F.]. The females lay their eggs on apple soon after the opening of the fruit buds, and the larvae hatch in 7–13 days. The larval stage lasts about three weeks, and the pupal stage about one. The young adults feed for about two weeks and then seek shelter in split bark and elsewhere. They begin a second period of activity in the latter part of August, but all seek hibernation sites by the end of September. In spray tests, poor results were given by DDT applied before oviposition, but addition of the sodium salt of DNC improved control. BHC was also effective and killed the eggs as well as the newly hatched larvae.

Dominik (J.). **Uwagi o występowaniu spuszczela** (*Hylotrupes bajulus* **L.) (Cerambycidae Col.) w północno-wschodniej części Wyżyny Łódzkiej.** [Remarks on the occurrence of *H. bajulus* in the north-eastern part of the Lodz plateau.]—*Sylwan* **103** no. 4 pp. 41–47, 1 map, 13 refs. Warsaw, 1959. (With summaries in Russian & English.)

Observations in 1958 showed that almost all the wooden buildings in the north-east of the Lodz plateau, in central Poland, are infested by *Hylotrupes bajulus* (L.), which apparently finds favourable conditions there. One of the main causes of infestation is the re-use of timber from old

buildings without prior disinfestation. Treatment of walls with a tar distillate affords no protection.

MARKELOVA (V. P.). *Exapate congelatella* **Cl. and** *Cacoecia rosana* **L. as pests of berry bushes in the Leningrad region.** [*In Russian.*]—*Rev. Ent. URSS* **36** pt. 2 pp. 355–369, 5 figs., 1 graph, 17 refs. Moscow, 1957. (With a summary in German.)

Exapate congelatella (Clem.) and *Archips* (*Cacoecia*) *rosanus* (L.) are serious pests of berry crops in the Leningrad region of the Soviet Union, the former occurring mainly on gooseberry and black currant and the latter on black currant and red currant. Observations in 1953–56 showed that the larvae of both species feed on the leaves, buds, flowers and fruits. *E. congelatella* destroyed up to 54 per cent. of the leaves, 24·7 per cent. of the flowers and 57 per cent. of the fruits in a gooseberry plantation in 1954, and *A. rosanus* destroyed up to 76 per cent. of the leaves, 18 per cent. of the flowers and 58 per cent. of the fruits of a black currant crop in 1955. Both species have one generation a year and overwinter in the egg stage.

The eggs of *E. congelatella*, all stages of which are described, were laid singly or in groups of 2–3 on the bark of old branches, usually on their lower or middle parts. Hatching began in late May or early June, when constant temperatures of not less than 10–12°C. [50–53·6°F.] and a sum of effective temperature of 113 day-degrees C. [203·4°F.] were reached. The threshold of development was found to be 4°C. [39·2°F.]. The larvae developed in 26–45 days, depending on temperature and were active for about 30 days. Pupation took place beneath the bark in late June or early July, and the pupal stage lasted about three months. Adult emergence began in late September and continued for 13–17 days. Females emerged a little earlier than males and were slightly less numerous. The adults were present for 30–35 days and were active by day, especially at midday, when the males made short flights. The females lived for about 12 days, and the males for about 14. The females had fully developed ovaries on emergence and laid an average of 110–120 eggs each, beginning 1–2 days after emergence and continuing for 2–5 days. In all, eggs were laid over a period of 18–24 days.

The eggs of *A. rosanus* were laid in closely packed batches on the bark of old bushes, the lower branches being preferred. The hatching period (May–June) was variable, but the threshold of development was 8°C. [46·4°F.] and the sum of effective temperature 45 day-degrees C. [81°F.]. The period of attack by the larvae lasted 35–47 days. Pupation took place inside the webbed leaves from late June, and the pupal stage lasted 12–16 days at 14–19°C. [57·2–66·2°F.]. Adult emergence began in early July and continued for 15–25 days. The adults were active between sunset and midnight and were present for 40–45 days, the females living for about 11 days and the males for about eight. Females were slightly more numerous than males, were sexually mature on emergence and laid 2–4 egg-batches of 42–53 eggs each. Oviposition began 2–3 days after emergence, and eggs were laid over 25–30 days. Parasites reared from *A. rosanus* comprised species of *Trichogramma*, including *T. evanescens* Westw., which attacked up to 15 per cent. of the eggs, and *Pimpla turionellae* (L.), *P. instigator* (F.), *Apechthis rufata* (Gmel.), *Phacogenes semivulpinus* (Grav.), *Phytodietus polyzonias* (Forst.), *Itoplectis viduata* (Grav.), *Blondelia* (*Ceromasia*) *nigripes* (Fall.), *Pseudoperichaeta roseanae* (B. & B.) which, together with an unidentified Tachinid, parasitised 8–10 per cent. of the larvae and pupae.

A. rosanus preferred bushes to trees, although in more southerly districts it is a serious pest of apple and pear. Field observations near Leningrad showed that temperatures at night, when the adults emerge and oviposition takes place, are several degrees higher in bushes than in the crowns of apple trees, and this probably influences the choice of food-plant.

In experiments on the control of the overwintering eggs of both species, good results were given in the laboratory by spring applications of several materials, including DDT in oil emulsion and 0·25 per cent. β-napthol in solar oil, and similar results were obtained on gooseberry in the field. In most cases, the eggs of *A. rosanus* were more resistant to sprays than those of *E. congelatella*, being laid in closely packed batches and covered by a protective secretion. In 1955, DDT in various forms was tested against the larvae of both species on black currant. A 4 per cent. suspension in water gave 94·5 per cent. mortality, a 0·2 per cent. emulsion spray gave 92·6 per cent. mortality, and a dust gave 90 per cent. mortality. When the dust was applied to about 12·5 acres of black currants infested by *A. rosanus*, it gave 89·1 per cent. mortality, and the maximum number of egg batches per bush in the following winter was reduced to 2, as compared with 11 on untreated bushes. Part of the plantation was dusted a second time immediately after flowering; 99·6 per cent. mortality was obtained, and no loss of crop was recorded. In 1956, a 4 per cent. suspension, applied after flowering to a neglected plot in which infestation by both pests was unusually high, gave 92·2 per cent. mortality, but considerable damage had already been done to the flowers and leaves. It is concluded that DDT is best applied when the larvae are hatching. If infestation is severe, two applications, one before and one after flowering, are recommended.

Beglyarov (G. A.). **The effect of DDT on the numbers of Tetranychoid mites and their predators.** [*In Russian.*]—*Rev. Ent. URSS* **36** pt. 2 pp. 370–385, 9 figs., 42 refs. Moscow, 1957. (With a summary in English.)

Treatment of crops with insecticides has been found in many countries to result in increases in Tetranychoid mites. Such mites are important pests on apple in the Krasnodar Region of the Soviet Union, and investigations on them and on their natural enemies were made in 1954–56. Examination of leaf samples showed that five Tetranychoids were present, *Bryobia redikorzevi* Rekk [which is within the scope of *B. praetiosa* Koch *sens. lat.*], *Tetranychus viennensis* Zacher (*crataegi* Hirst), *T. telarius* (L.) (*urticae* Koch), *Panonychus* (*Metatetranychus*) *ulmi* (Koch) and *Cenopalpus pulcher* (C. & F.) (*Brevipalpus oudemansi* (Geijskes)). The first two were the most important, and they were most numerous in June–July and July–August, respectively. *P. ulmi* occurred only in the coastal areas, and the other two were not numerous though widespread. The predators comprised 11 species of Phytoseiids, three other mites and nine species of insects in seven families. *Typhlodromus aberrans* Oudm. was the only predator of importance, and it was present both earlier and later in the season than the phytophagous mites, feeding on other arthropods in their absence. Its development required an average of only 9·1 days, and the females oviposited 3–7 days after pairing, but laid only 16–18 eggs each. Populations of *Bryobia* and *Tetranychus viennensis* were greatest and those of the Phytoseiids and other predators least in orchards sprayed with DDT, which reduced the numbers of the predators but not of the phytophagous mites, thus allowing the latter to increase.

Chin (Chun-teh). **Studies on the locust egg. III. On the water loss and the ability to survive desiccation of the eggs of the oriental migratory locust,** *Locusta migratoria manilensis* **Meyen.** [*In Chinese.*]—*Acta ent. sin.* **8** no. 3 pp. 207–225, 9 figs., 18 refs. [Peking] 1958. (With a summary in English.)

In laboratory studies in China on water loss from the eggs of *Locusta migratoria manilensis* (Meyen), it was found that the rate of evaporation, estimated as the quantity of water lost per unit of surface area in unit time, was greatest in eggs incubated at 30°C. [86°F.] for 13 days and in those approaching hatching, medium in newly laid eggs and lowest in eggs that had undergone anatrepsis, the ratio being 4 : 2 : 1. The differences were due to structural and functional changes in the egg membranes, as well as to the actual water content. The rate of desiccation, calculated as the percentage water loss in unit time, was greatest in newly laid eggs, which contained the least amount of water, and least in half-developed eggs. When the eggs were exposed to air, the evaporation rate agreed fairly well with the saturation deficit, but the nature of the egg membranes prevented exact prediction of evaporation and were affected by temperature. The functions of the various protective structures in the egg are discussed. The posterior end was not the sole route of water loss, but it differed from other parts of the chorion.

The water absorbed by the egg is important for development, and temporary loss of water led to delay in hatching. Eggs approaching hatching were the most resistant to water loss, and newly laid eggs the least. The greater resistance of the older eggs appears to be partly due to the formation of metabolic water.

Sun (Hsi-lin) & Liu (Yuan-fu). **A preliminary study on the influence of parasites upon the outbreak of pine caterpillar (***Dendrolimus punctatus* **Walk.) in Tung-an, Hunan Province.** [*In Chinese.*]—*Acta ent. sin.* **8** no. 3 pp. 235–246, 3 graphs, 9 refs. [Peking] 1958. (With a summary in English.)

Dendrolimus punctatus (Wlk.) is an important pest of pine trees in China [*cf. R.A.E.*, A **47** 78], but has numerous natural enemies. A study of these was made in 1954 at Tung-an, in Hunan, on *Pinus massoniana*. The eggs were parasitised by *Telenomus dendrolimusi* Chu, *Trichogramma evanescens* Westw., *Anastatus gastropachae* Ashm., *Mesopolobus* (*Eutelus*) *tabatae* (Ishii), *Pachyneuron nawai* Ashm. and *Eupteromalus* sp., of which the first three were the most important. Parasitism reached 12·76 per cent. in the first generation and 40·61 per cent. in the second, the percentages due to *Telenomus* being 5·83 and 33·45, respectively. The larvae were parasitised by *Campoplegidea* (*Campoplex*) *bicoloripes* (Ashm.), *Rhythmonotus takaqii* (Mats.), *Rogas spectabilis* (Mats.), *Phanerotoma flavida* End., *Apanteles liparidis* (Bch.), *Sarcophaga peregrina* R.-D., two unidentified Tachinids and a fungus, *Beauveria bassiana*, of which the fungus and the Diptera were the most important. Mortality, which was mostly due to parasitism, reached 56·62 per cent. among the overwintered larvae, 82·83 per cent. among larvae of the first generation and 40·83 per cent. among those of the second generation. The pupae were parasitised by *Xanthopimpla japonica* Krieger, *Brachymeria obscurata* (Wlk.), *Stenaracoides octocinctus* (Ashm.), *Pimpla disparis* Vier., *Ephialtes* (*Iseropus*) *satanas* (Morley), *Sarcophaga peregrina*, Tachinids and *Beauveria bassiana*, of which *X. japonica*, the Diptera and the fungus were the most important. The percentage of pupae that failed

to transform to the adult stage because of attack by the fungus was 36·68 in the overwintered generation and 40·11 in the first generation, as compared with 54·72 and 66·7 per cent. total mortality, respectively, most of which was due to parasitism.

CHEN (Jen-ti). **Morphology and habit of six main borers of the tea bush.** [*In Chinese.*]—*Acta ent. sin.* **8** no. 3 pp. 272–280, 4 pls., 7 refs. [Peking] 1958. (With a summary in English.)

Tea bushes in Fukien are attacked by *Casmara patrona* Meyr., *Parametriotes theae* Kusnetsov, *Linoclostis gonatias* Meyr., *Acolesthes induta* (Newm.), *Chreonoma atritarsis* Pic and *Agrilus* sp. The morphology and habits of these borers are described. *Casmara* and *Acolesthes* cause the stems to decay, and *Parametriotes* damages the tender shoots, causing a decrease in leaf production.

CHANG (Yin-gian). **Preliminary study on a species of *Citrus* tree borer, *Chelidonium argentatum* (Dalman) (Coleoptera, Cerambycidae).** [*In Chinese.*]—*Acta ent. sin.* **8** no. 3 pp. 281–289, 6 figs., 3 refs. [Peking] 1958. (With a summary in English.)

Chelidonium argentatum (Dalm.), all stages of which are described, is injurious to *Citrus* in Foochow. Observations in 1951–52 showed that the adults appear from 20th May to 10th July or sometimes to 10th August. Eggs are laid on the slender branches and hatch in 18–19 days, and the larvae bore in the wood of the branches for 180–200 days. They overwinter from December or January and pupate in mid-April, the pupal stage lasting 23–25 days. There is only one generation a year.

SEIKA (Y.). **The experimental method of forecasting the occurrence of the rice stem borer in the first generation. I. The method to forecast the peak date of moth appearance and the population of the moths emerging in the later period of the first generation.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **2** no. 2 pp. 123–127, 1 graph. Tokyo, 1958. (With a summary in English.)

The following is based on the author's summary. Experiments in Japan showed that the date of the peak of emergence of first-generation adults of *Chilo suppressalis* (Wlk.) on rice can be forecast from a knowledge of the date of peak pupation under room conditions, which occurred about 13 days earlier. The method gave good results in Ehime Prefecture.

KISIMOTO (R.). **Studies on the diapause in the planthoppers. Effect of photoperiod on the induction and the completion of diapause in the fourth larval stage of the small brown planthopper, *Delphacodes striatella* Fallén.**—*Jap. J. appl. Ent. Zool.* **2** no. 2 pp. 128–134, 4 graphs, 12 refs. Tokyo, 1958. (With a summary in Japanese.)

The following is based on the author's summary. *Delphacodes striatella* Fall., which attacks rice in Japan, hibernates in the fourth nymphal instar among weeds growing near the rice-fields, the adults emerging in spring. The effect of photoperiod on the induction and completion of the diapause was studied at 20–22°C. [68–71·6°F.]. It was found that diapause occurred

in all nymphs at a short photoperiod of 8–10 hours and in none at a long one of over 14 hours. Nymphs in diapause retained their sensitivity to photoperiod, a long one inducing resumption of development, which was completed in 2–3 weeks.

Koidsumi (K.) & Makino (K.). **Intake of food during hibernation of the rice stem borer, *Chilo suppressalis* Walker.**—*Jap. J. appl. Ent. Zool.* **2** no. 2 pp. 135–138, 1 graph, 7 refs. Tokyo, 1958. (With a summary in Japanese.)

The following is based on the authors' summary. Larvae of *Chilo suppressalis* (Wlk.) hibernating in rice straw in Japan gnaw the straw at the beginning and end of the hibernation period. This was shown to be true feeding, so that dormancy occurs only during the coldest part of the season. In the district of Gifu, it lasted from the beginning of January to mid-March.

Hukusima (S.). **The effect of varying nitrogen levels in nutrition upon the arthropod fauna in young apple trees, with special reference to the increase of the mite and aphid populations. (Studies on the insect association in crop field, 14.)**—*Bull. Fac. Agric. Hirosaki Univ.* no. 4 pp. 72–79, 1 graph, 12 refs. Hirosaki, 1958. (With a summary in Japanese.)

The experiments described were carried out in Japan to ascertain whether the level of nitrogen-nutrition in water culture had any effects on the composition of the arthropod fauna of apple trees. There were no significant differences in composition, but the population density was always greater on trees with a high level of nitrogen-nutrition than on those deficient in this element. *Panonychus ulmi* (Koch) produced more offspring as the nitrogen level was increased, but *Tetranychus telarius* (L.) and aphids became more abundant on nitrogen-deficient plants [*cf. R.A.E.*, A **48** 402].

Todd (D. H.). **Incidence and parasitism of insect pests of cruciferous crops in Hawke's Bay, Wairarapa, Manawatu, Rangitikei, and Taranaki, 1956–57.**—*N.Z. J. agric. Res.* **1** no. 6 pp. 847–858, 2 figs., 1 map, 2 refs. Wellington, N.Z., 1958.

The findings in a survey of insect pests of cruciferous crops and their parasites in three areas in the North Island of New Zealand in 1955–56 are summarised [*cf. R.A.E.*, A **46** 372], and the results of a similar one in five districts in 1956–57 are described. The following is based almost entirely on the author's summary of the results. *Pieris rapae* (L.) caused damage, mostly at the margins of the crops, in all districts. The virus disease [*cf.* **46** 373] was again prominent in checking this species, particularly during the latter part of the season, when populations were relatively high. No recoveries of the larval parasite, *Apanteles glomeratus* (L.), were made, but pupae collected were heavily parasitised by *Pteromalus puparum* (L.). Sporadic attacks by *Plutella maculipennis* (Curt.) occurred in one district, where a high proportion of the larvae and pupae were attacked by a fungus, probably *Entomophthora sphaerosperma* [*cf.* **28** 155], which caused considerable mortality. The larval parasite, *Angitia cerophaga* (Grav.), was recovered from all districts. Parasitism by the pupal parasite, *Thyraella* (*Diadromus*) *collaris* (Grav.), was confined to three districts.

No serious outbreak of *Brevicoryne brassicae* (L.) was recorded, though populations were high in some areas.

Lowe (A. D.) & Dromgoole (W. V.). **The development of an electronic aphid-counter.**—*N.Z. J. agric. Res.* **1** no. 6 pp. 903–912, 4 figs., 7 refs. Wellington, N.Z., 1958.

The following is the authors' summary. Various methods of estimating aphid populations are discussed and their limitations are noted. Details are given of the construction and operation of an electronic counter by means of which normal colonies of aphids can be counted with a repeatability of ± 3 per cent. It is essentially an instrument for use in the laboratory, where a stable power supply is normally available.

Weiser (J.) & Beard (R. L.). *Adelina sericesthis* **n. sp., a new Coccidian parasite of Scarabaeid larvae.**—*J. Insect Path.* **1** no. 2 pp. 99–106, 19 figs., 4 refs. New York, N.Y., 1959.

The following is based on the authors' summary. Third-instar larvae of *Sericesthis pruinosa* (Dalm.) in lawns at Canberra, Australia, were found in 1953 to be infected with a Coccidian parasite, which is here described, on the basis of its cytology, life-cycle and host, as *Adelina sericesthis*, sp. n. [*cf.* also *R.A.E.*, A **46** 191]. The parasite primarily invades and ultimately breaks down the fat-body of the larvae. Its pathogenicity is low, but early infections prevent pupation. Body-fluid from heavily infected larvae contained various stages of the parasite and an abnormal number of circulating cells; it melanised excessively when exposed to air. The parasite is not specific to *S. pruinosa*, and at least one larva of *Aphodius tasmaniae* Hope (*howitti* Hope) was infected with it by means of contaminated food.

Abul-Nasr (S.). **Further tests on the use of a polyhedrosis virus in the control of the cotton leafworm** *Prodenia litura* **Fabricius.**—*J. Insect Path.* **1** no. 2 pp. 112–120, 12 refs. New York, N.Y., 1959.

The larvae of *Prodenia litura* (F.) have been found in Egypt to be infected with an apparently indigenous polyhedral virus disease [*cf. R.A.E.*, A **48** 175, etc.]. In preliminary field tests of its value for control, it gave good mortality but the results were complicated by migration of the larvae from unsprayed plants into the sprayed plot, and three further tests were carried out in which migration was prevented. The following is based on the author's summary of the work.

The virus was used as a diluted suspension (1:500) of the original virus material (the liquefied bodies of virus-killed larvae). The treated plants were cotton, sweet potatoes and maize. The first two crops were infested with second- and third-instar larvae, and the third with grown larvae. The virus infected the young larvae and caused them to die, thus keeping the pest infestation below the economic level. Grown *Prodenia* larvae on maize were not successfully infected, either because of their transformation into pupae or because the virus did not contact the hidden larvae, and mortality was low. Since larval migration was prevented, the population density of living larvae was much higher in the untreated area than in the virus-treated plots. A natural epizootic of the disease occurred on Egyptian clover [*Trifolium alexandrinum*] in October 1958, and destroyed all *Prodenia* larvae in different instars in a highly infested area.

Stevenson (J. P.). **An infection of the desert locust, *Schistocerca gregaria* Forskål with a nonchromogenic strain of *Serratia marcescens* Bizio.**—*J. Insect Path.* **1** no. 2 pp. 129–141, 4 graphs, 8 refs. New York, N.Y., 1959.

The following is virtually the author's summary. From an epizootic occurring among laboratory stocks of *Schistocerca gregaria* (Forsk.), a gram-negative bacterium was isolated and later identified as a non-chromogenic strain of *Serratia marcescens*. Bacteria-free filtrates of diseased tissues gave no indication of a virus aetiology, and no organisms other than bacteria were found in the tissues of insects killed by the disease. Inoculation of pure cultures of strains of *S. marcescens* isolated from dead locusts resulted in death, with typical signs of the disease. The organism could be re-isolated, and cultured on artificial media. It was found not to be a member of the normal flora of the alimentary canal, and feeding experiments, taken in conjunction with the other results, indicated that it was the aetiological agent of the disease.

Stern (V. M.), Hall (I. M.) & Peterson (G. D.). **The utilization of *Bacillus thuringiensis* Berliner as a biotic insecticide to suppress the alfalfa caterpillar.**—*J. Insect Path.* **1** no. 2 pp. 142–151, 11 refs. New York, N.Y., 1959.

The following is virtually the authors' summary. Two field tests were conducted in California in 1958 using ground and airplane equipment in applying commercially-produced spore material of *Bacillus thuringiensis* as sprays on lucerne to control *Colias eurytheme* Boisd. [*cf. R.A.E.*, A **40** 154]. Where ground equipment was used, the spore material was applied over a range of 1·8–18 oz. per acre (each g. of spore material contained approximately 40,000 million viable spores). Two days after application, control was satisfactory where 7·8 or 18 oz. of spore material was applied per acre, and excellent control was attained with all treatments at the end of four days at dosages as low as 1·8 oz. per acre. The large larvae, which are the most damaging, were affected sooner than the smaller larvae.

Two dosages of spore material (1·4 and 4·3 oz. per acre) were applied by aircraft. Results were not quite satisfactory where the lower dosage was applied, but were adequate where 4·3 oz. per acre was applied. The results suggest that if 3–4 oz. of spore material per acre is applied by ground equipment, and 4–5 oz. by airplane, commercial control of the pest should be as satisfactory as with a chemical insecticide.

Heimpel (A. M.) & Angus (T. A.). **The site of action of crystalliferous bacteria in Lepidoptera larvae.**—*J. Insect Path.* **1** no. 2 pp. 152–170, 8 figs., 14 refs. New York, N.Y., 1959.

The following is based on the authors' summary. Differences in the response of the larvae of various species of Lepidoptera to the toxin produced by crystalliferous bacteria of the group of *Bacillus thuringiensis* necessitate the division of susceptible Lepidoptera into three types. X-ray studies showed that insects of type I, which include *Bombyx mori* (L.), *Protoparce quinquemaculata* (Haw.) and *Antheraea pernyi* (Guér.), and type II, which include *Malacosoma disstria* Hb., suffer from paralysis of the midgut a few minutes after ingesting the toxin. Insects of type I are stricken by a

general paralysis, ended by death, in 1–7 hours, and the paralysis was found to be due to an increase in the pH value of the body-fluid. The increase is thought to be caused by the leakage of alkaline gut contents through the damaged gut into the poorly buffered body-fluid. Insects of type II suffer no such increase and die in 2–4 days without general paralysis. The sole known representative of type III is *Anagasta kühniella* (Zell.), and it dies in 2–4 days without symptoms of general paralysis. Unlike insects of types I and II, it is not killed by the ingestion of toxin in the absence of spores, which must apparently germinate in the presence of the crystalline toxin and grow in the midgut before causing death.

Steinhaus (E. A.) & Dineen (J. P.). **A cytoplasmic polyhedrosis of the alfalfa caterpillar.**—*J. Insect Path.* **1** no. 2 pp. 171–183, 10 figs., 7 refs. New York, N.Y., 1959.

The following is virtually the authors' summary. A cytoplasmic polyhedrosis was found in 1958 affecting the midgut of larvae of *Colias eurytheme* Boisd. in California. Externally, the diseased larvae exhibit a yellowish-green colour over the midgut region. Upon dissection, the midgut is seen to have assumed a yellowish opaque appearance. Histological sections show the cytoplasm of the gut cells to contain polyhedra of two general-size groups. Electron micrographs of alkaline-dissolved polyhedra reveal the presence of numerous spherical particles presumed to be the virus. The diseased larvae were originally observed during laboratory experiments in specimens subjected to the stress of crowding; but similarly diseased larvae were also collected from lucerne in California in 1959. The disease appears to be caused by a spherical virus of the type placed in the genus *Smithia-virus*. It is unrelated to *Borrelinavirus campcoles*, which causes nuclear polyhedrosis in *C. eurytheme* [*cf. R.A.E.*, A **43** 185, etc.]

Lysenko (O.) & Sláma (K.). **The relation between oxygen consumption and bacterial infection in sawflies.**—*J. Insect Path.* **1** no. 2 pp. 184–188. 1 graph, 3 refs. New York, N.Y., 1959.

The following is virtually the authors' summary. The authors examined the relation between oxygen consumption and bacterial infection caused by *Serratia marcescens* in diapause pronymphs of *Cephalcia abietis* (L.). They found that the bacterial action in the insect body causes an increase in the oxygen consumption of the insect host. The duration of the incubation period, which may be accurately determined by this method, is in an inverse correlation to the infection dosage of bacteria administered. The properties of insect defence against bacterial infection are discussed from this point of view.

Thompson (C. G.). **Thermal inhibition of certain polyhedrosis virus diseases.**—*J. Insect Path.* **1** no. 2 pp. 189–190. New York, N.Y., 1959.

Laboratory studies with Lepidoptera showed that some species are able to withstand temperatures that inhibit the activity of nuclear polyhedrosis viruses associated with them. The viruses of *Trichoplusia ni* (Hb.) and *Heliothis zea* (Boddie) proved incapable of infecting their hosts by ingestion at temperatures of 39°C. [102·2°F.] or above, but that of *Prodenia* sp. did

so at temperatures as high as 46°C. [114·8°F.]. All three insects were readily infected at 35°C. [95°F.], but the results were variable with *T. ni* and *H. zea* between 35 and 39°C. The phenomenon appeared to be due, not to inactivation of the virus, but to inability to invade certain hosts at high temperature. The disease was not inhibited when the insects were exposed to the latter after infection was established.

Banks (C. J.) & Nixon (H. L.). **The feeding and excretion rates of *Aphis fabae* Scop. on *Vicia faba* L.**—*Ent. exp. appl.* **2** no. 2 pp. 77–81, 1 graph, 11 refs. Amsterdam, 1959. (With a summary in German.)

The following is substantially the authors' abstract. The feeding and excretion rates of nymphs of *Aphis fabae* Scop., feeding on young leaves of broad bean (*Vicia faba*), were studied, using plants grown in water culture and made radioactive with ^{32}P. The amounts of sap ingested at first were small, but the rate of ingestion increased rapidly between 12 and 16 hr. The maximum rate of feeding was estimated at 0·2 mg. sap per hour, an uptake of 59 per cent. of the mean body weight of the insects per hour. The excretion rate was variable. The results are discussed in relation to other recent work on aphid feeding and excretion [*cf. R.A.E.*, A **42** 215, 320].

Burgerjon (A.) & Klingler (K.). **Détermination au laboratoire de l'époque de traitement de *Tortrix viridana* L. avec une préparation à base de *Bacillus thuringiensis* Berliner.**—*Ent. exp. appl.* **2** no. 2 pp. 100–109, 1 pl., 6 figs., 12 refs. Amsterdam, 1959. (With a summary in German.)

The following is based on the authors' summary. In a laboratory experiment in France, sprays made up from a preparation of *Bacillus thuringiensis* were tested at various periods against the larvae of *Tortrix viridana* (L.) on oak. It was found that applications made at the beginning of hatching or after larvae had entered buds were ineffective, but that good control resulted when the sprays were applied at the peak of hatching, when the leaves were opening. Higher concentrations were required if the leaves had fully expanded.

Maramorosch (K.). **An ephemeral disease of maize transmitted by *Dalbulus elimatus*.**—*Ent. exp. appl.* **2** no. 2 pp. 169–170, 1 pl., 4 refs. Amsterdam, 1959. (With a summary in German.)

During a study of maize diseases in Mexico, a colony of *Dalbulus elimatus* (Ball) from Chapingo was maintained on maize in the greenhouse. Two of several hybrid sweet maize plants on which 30 nymphs fed for seven days developed swellings along the secondary veins on the lower surfaces of the leaves. These increased after removal of the insects, but gradually disappeared after 12 days, so that the plants were normal after 25 days; there were no systemic symptoms. Six adults from the nymphs responsible caused slightly enlarged veins on one of 25 plants. Adults and nymphs of *D. elimatus* and the closely related *D. maidis* (DeLong & Wolc.) that fed for five days on the original two plants with affected leaves caused no symptoms when transferred to healthy plants. It is concluded that the condition was due to an insect toxin and not to a virus.

The symptoms produced on the original plants closely resembled those of a condition known as wallaby-ear disease of maize in Queensland, which has been thought, but not proved, to be caused by a virus; *Cicadulina bimaculata* (Evans) has been incriminated as the vector [*cf. R.A.E.*, A **31** 47]. The author was informed by Day that the progeny of infective females can cause this disease without having fed on diseased plants. Whether it is of similar nature to the Mexican disease is not known.

Norris (M. J.) (Mrs. O. W. Richards). **The influence of day-length on imaginal diapause in the red locust, *Nomadacris septemfasciata* (Serv.).** —*Ent. exp. appl.* **2** no. 2 pp. 154–168, 1 graph, 13 refs. Amsterdam, 1959. (With a summary in French.)

Much of the information on the influence of day-length on diapause in adults of *Nomadacris septemfasciata* (Serv.) here given has been noticed from a less detailed source [*R.A.E.*, A **47** 498]. It is further pointed out that, when reared under constant conditions in the laboratory in London, adults that emerged between about mid-August and the end of September remained in diapause for 7–8 months, those that emerged between October and mid-December for 4½–5½ months, and those that emerged after January passed through progressively decreasing periods of diapause and formed a link with non-diapause adults emerging at the beginning of April. Adults that emerged towards the end of summer or in autumn and were exposed to artificial photoperiods progressively increasing in length to simulate spring conditions matured at the same rate as those that emerged during the months simulated; the rate of maturation was influenced only by the seasonal conditions experienced by the adults and not by those to which they were exposed as hoppers. The shorter diapause of adults emerging in late autumn did not result from exposure to lengthening daylight at an earlier stage in adult life, however, since they matured at about the same rate when exposed to constant short photoperiods. Adults that emerge in February–March are exposed to lengthening daylight still earlier in adult life, and in their case this exposure shortens or inhibits diapause; when such adults were subjected to constant short photoperiods they matured more slowly and passed through a period of diapause similar in duration to that of short-diapause locusts. It is concluded that, under short-day conditions, the maturation processes are resumed and diapause is terminated at a certain developmental stage independently of day-length and as a result of an internal stimulus; exposure to long-day conditions can accelerate them only if it occurs before this stage is reached. The cause of the long diapause of adults that emerge at the beginning of autumn is not known, but it seems probable that the change from long to short days can itself induce a longer diapause than exposure only to short days throughout development [*loc. cit.*]. Adults kept in constant darkness matured without diapause.

Norris (M. J.) (Mrs. O. W. Richards). **Reproduction in the red locust (*Nomadacris septemfasciata* Serville) in the laboratory.**—*Anti-Locust Bull.* no. 36, [2+] 46 pp., 3 figs., 22 refs. London, 1959.

The following is virtually the author's summary. The effects of crowding and isolation on the duration of hopper life and on adult weight, colour and morphometrics of *Nomadacris septemfasciata* (Serv.) are compared. Locusts emerging as adults in the laboratory in England from April to July inclusive become sexually mature in a few weeks, but those emerging in late summer

and autumn have a prolonged imaginal diapause, comparable with, although shorter than, that of wild *Nomadacris* [*cf. R.A.E.*, A **41** 235], and do not become mature until the following spring. Experiments have shown that the seasonal changes in day-length are responsible for the onset of diapause [*cf.* preceding abstract, etc.]. The changes in adult coloration and body-weight that occur between emergence and sexual maturation are described. Both diapause and non-diapause males and females increase their weight by about 50 per cent. during the first two or three weeks of adult life. After this, non-diapause females continue to increase in weight until oviposition, but the weight of diapause females remains stationary for several months, during which the ovaries remain undeveloped.

The quantities of grass (dry weights) eaten by the locusts at different periods of adult life were estimated. Although the consumption of diapause groups falls to a low level during the diapause period, their consumption during early adult life does not necessarily differ from that of non-diapause groups. The first pods in groups of non-diapause locusts were laid in from 36 to 63 days. The average interval between the first pairing and the first oviposition was 5·4 days. In diapause groups emerging in August and September, the first pods were laid in from 190 to 235 days. The length of the diapause in groups emerging later in the autumn is shorter and the first pods were laid at the age of 134 to 183 days. The maturation time of groups emerging after December decreases progressively until April. The addition of mature males to diapause groups abbreviated but did not prevent diapause. Maturation time in crowded adults tends to be shorter than that of adults kept in single pairs, whether the latter are isolated throughout life (*solitaria*) or during adult life only (isolated *gregaria*) [*cf.* **40** 400]. This is mainly due to the synchronising effect of crowding, which prevents delay in potentially late-maturing individuals. Density does not in general affect the incidence of diapause, which occurs seasonally in crowded and isolated individuals alike. In one preponderantly non-diapause batch, however, some isolated males entered diapause. Egg-pods were laid by the mature females in both diapause and non-diapause groups at the rate of one pod in eight days. Crowded diapause females laid an average of 3·4 pods each and non-diapause ones an average of four pods. The difference is probably not significant. Both *solitaria* females and females isolated in pairs during the adult stage only (isolated *gregaria*) laid an average of about six pods each. The average number of eggs in the pods laid by crowded females was 97. The number was slightly but significantly increased when the adults were kept in isolated pairs. A high proportion of the first pods laid by non-diapause females are totally sterile. The incidence of such sterility is virtually confined to groups maturing before the age of seven weeks, in which the males mate before sperm is present, so that the eggs are not fertilised. Since sperm begins to appear during the eighth week, sterility from this source does not occur in diapause groups. Females in these groups do, however, sometimes lay unfertilised eggs when they become mature before the males and oviposit before pairing. This occurs more often in isolated pairs than in crowded locusts, and sometimes in non-diapause *solitaria*, although not in non-diapause crowds. A fairly large percentage of the eggs in fertile pods are also often sterile. No significant effect of density on such sterility was demonstrated.

The duration of adult life in the female is closely related to maturation time and averaged 69 days in non-diapause *gregaria*, 108 days in non-diapause *solitaria* and 256 days in diapause *gregaria*. Diapause males lived much longer than most non-diapause ones, but after maturity some of the latter lived for long periods and their total length of life was much less closely related to maturation time than that of the females.

Anderson (C. W.). *Vigna* **and** *Crotalaria* **viruses in Florida. V. Comparative transmission tests with aphids and beetles.**—*Phytopathology* **49** no. 2 pp. 117–118, 7 refs. Baltimore, Md., 1959.

In experiments in Florida, examples of *Myzus persicae* (Sulz.) were starved, given short acquisition feeding periods on plants infected with cowpea mosaic [*cf. R.A.E.*, A **42** 142, etc.] or the cowpea strain of cucumber mosaic, and placed on healthy plants of cowpea or pepper [*Capsicum*], respectively. They transmitted both viruses. In tests with adults of *Cerotoma trifurcata* (Forst.) [*cf.* **38** 150] on cowpea, the beetles transmitted neither of these viruses nor virus 2B (a lupin virus obtained by M. K. Corbett and considered a strain of bean yellow mosaic virus).

Laird jr. (E. F.) & Dickson (R. C.). **Insect transmission of the leaf-crumple virus of cotton.**—*Phytopathology* **49** no. 6 pp. 324–327, 5 refs. Baltimore, Md., 1959.

The following is based on the authors' summary. In greenhouse tests in California, the leaf-crumple virus [*cf. R.A.E.*, A **43** 276] was transmitted from cotton to cotton (the Acala variety of *Gossypium hirsutum*) by *Bemisia tabaci* (Gennadius), of which *B. inconspicua* (Quaint.) is a synonym [*cf.* **46** 136], but not by *Trialeurodes abutilonea* (Hald.). It was transmitted by single adults of *B. tabaci*, but not by immature forms. The acquisition feeding and inoculation feeding thresholds were, respectively, 4–8 and 1–2 hours. The virus was retained by the adults for five days and was not transmitted through the egg. Stub cotton plants were as potent virus sources as newly infected plants. Egyptian cotton was also susceptible to the virus. On the basis of virus-vector relations, the leaf-crumple virus is similar to the leaf-curl virus of cotton, but it is distinct from it on the basis of symptoms. Seed transmission was not demonstrated.

Toko (H. Y.) & Bruehl (G. W.). **Some host and vector relationships of strains of the barley yellow-dwarf virus.**—*Phytopathology* **49** no. 6 pp. 343–347, 16 refs. Baltimore, Md., 1959.

The following is based on the authors' summary. In investigations in Washington State, two vector-specific strains of the barley yellow-dwarf virus were detected. One (from self-sown barley) was transmitted by *Rhopalosiphum fitchii* (Sand.), and the other (from wild oats) by *Macrosiphum avenae* (F.) (*granarium* (Kby.)). The feeding periods necessary for acquisition and transmission were similar, but acquisition feeds of 24 hours and inoculation feeds of 4–8 hours were required for infections to be more than rare, and lengthening either period increased the efficiency of transmission. Both nymphs and adults served as vectors.

Sill jr. (W. H.) & del Rosario (M. S.). **Transmission of wheat streak mosaic virus to corn by the Eriophyid mite,** *Aceria tulipae*.—*Phytopathology* **49** no. 6 p. 396, 6 refs. Baltimore, Md., 1959.

Maize in Kansas is resistant to the virus of wheat streak mosaic and is seldom infested by *Aceria tulipae* (Keifer), which transmits it, but tests there showed that this Eriophyid is able to transmit the virus from wheat to maize and back from maize to wheat.

Jones (J. P.). **Failure of thrips to transmit an isolate of tomato spotted wilt virus.**—*Phytopathology* **49** no. 7 pp. 452–453, 7 refs. Baltimore, Md., 1959.

A virus disease of tomato with symptoms resembling those of tomato spotted wilt occurs in the Lincoln area of Nebraska. In extensive tests, it was not transmitted by *Thrips tabaci* Lind., which transmits spotted wilt.

Forsberg (J. L.). **Relationship of the bulb mite *Rhizoglyphus echinopus* to bacterial scab of gladiolus.** (Abstract.)—*Phytopathology* **49** no. 9 p. 538. Baltimore, Md., 1959.

Bacterial scab of *Gladiolus*, caused by *Pseudomonas marginata*, has been controlled in the United States since 1954 by treating the soil at planting time with aldrin or heptachlor, indicating that the bacterium is transmitted by soil arthropods. Clean and scabby corms all produced scabby corms when planted in the greenhouse in soil from an infected field and healthy corms when planted in steam-sterilised soil. *Rhizoglyphus echinopus* (Fum. & Rob.) was found on all scabby corms, but on no healthy ones, and the bacterium developed on all agar plates to which the mites had been transferred. The mites increased rapidly on the plates, and severe scab developed on plants grown in soil infested with mites from the culture. Only a few minor lesions appeared when a broth culture of the bacterium was added to the soil, and none on control plants. Mites on the plates were all dead five days after granules containing 20 per cent. aldrin had been scattered over the agar.

Frederiksen (R. A.) & Goth (R. W.). **Crinkle, a new virus disease of flax.** (Abstract.)—*Phytopathology* **49** no. 9 p. 538. Baltimore, Md., 1959.

A new virus disease, tentatively named flax crinkle, was observed for the first time on self-sown flax at St. Paul, Minnesota, in the autumn of 1956. In 1957, it was found in all fields of flax in Minnesota and North and South Dakota. The percentage of plants infected was 20 in occasional fields and 64 in some test plots at St. Paul. All commercial flax varieties tested were susceptible to it, and it significantly reduced the yield of seed. The characteristic symptoms are protrusions at irregular intervals on the principal lateral veins on the apical leaves of the main stem or tillers. The virus is transmitted by *Macrosteles fascifrons* (Stål) and by dodder (*Cuscuta*).

Rochow (W. F.). **Transmission of strains of barley yellow dwarf virus by two aphid species.**—*Phytopathology* **49** no. 11 pp. 744–748, 15 refs. Baltimore, Md., 1959.

The following is based on the author's summary. In 1957–58, in New York, 80 oat plants with symptoms of disease caused by the barley yellow-dwarf virus were tested for infection by the use of *Rhopalosiphum fitchii* (Sand.) and *Macrosiphum avenae* (F.) (*granarium* (Kby.)). The virus was transmitted only by the first from two plants, only by the second from 67, and by both from six [*cf. R.A.E.*, A **48** 417]. The two isolates transmitted only by *R. fitchii* and two transmitted only by *M. avenae* were studied, and their vector-specificity remained essentially unchanged after a total of 129 transfers, including 11 serial transmissions of each isolate, although occasional transmission by the ' non-vector ' species occurred.

Maramorosch (K.). **Beneficial effect of virus-diseased plants on non-vector insects.**—*Tijdschr. PlZiekt.* **64** pt. 5–6 pp. 383–391, 23 refs. Wageningen, 1958. (With a summary in Dutch.)

The following is based on the author's summary. The tests described were carried out in view of reports of the increased length of life of insects feeding on plants infected with viruses of which they are the vectors. Instead of using virus-free and virus-infected plants of the species on which a vector ordinarily feeds, an unsuitable food-plant was chosen. *Dalbulus maidis* (DeLong & Wolc.) could not be maintained on healthy China aster (*Callistephus chinensis*), but survival of adults and nymphs was nearly as great on asters severely infected with aster-yellows virus, as on maize, their proper food-plant. Adults and nymphs maintained on diseased asters became conditioned to the new food-plant and could later be maintained also on healthy asters, though no progeny was obtained. It could not be established whether the beneficial effect of feeding on diseased plants was caused by acquisition of the virus. Although retained by the leafhoppers, it was not transmitted by them to aster plants. It is concluded that their prolonged survival on healthy aster after feeding on diseased plants is a conditioning phenomenon. The possible mechanisms involved and the usefulness of the system for further studies are discussed.

Leigh (T. F.) & Smith (R. F.). **Flight activity of *Colias philodice eurytheme* Boisduval in response to its physical environment.**—*Hilgardia* **28** no. 19 pp. 569–624, 23 figs., 53 refs. Berkeley, Cal., 1959.

The following is virtually the authors' abstract. Field studies were made of body temperature and flight activity of *Colias eurytheme* Boisd., in relation to solar and other radiation, light, air temperature, and moisture, in lucerne fields in the San Joaquin Valley of California in 1952–53. Some of the response factors were also studied under controlled laboratory conditions. Solar radiation appears to be the most important agent affecting body temperature, but its effect is in turn modified by air temperature and the cooling of the insect through evaporation. Under sufficiently high radiation, and when air temperature is not too low, *Colias* increases its body temperature by orienting perpendicular to the sun. When body temperature nears the critical high level, *Colias* appears able to regulate it by decreased flight, rest in shade or on moist soil or algal scum, or by taking water while at rest, thus permitting cooling without desiccation. When air temperature and radiation approach limiting levels, however, desiccation can limit flight even if body temperature is below the upper critical level, especially where there is no source of water or nectar. On the other hand, peak solar radiation may not limit flight if low air temperature and evaporation keep the body temperature within the favourable range for activity. Low light intensity is the only factor of those studied that, alone, caused cessation of flight when all other factors were favourable.

Smith (R. F.). **The spread of the spotted alfalfa aphid, *Therioaphis maculata* (Buckton), in California.**—*Hilgardia* **28** no. 21 pp. 647–685 [+9], 3 figs., 1 graph, 19 maps, 23 refs. Berkeley, Cal., 1959.

Therioaphis maculata (Buckt.) was first observed damaging lucerne in California in mid-June 1954 [*cf. R.A.E.*, A **45** 11] and spread over 97·5 per cent. of the lucerne-growing area of the State within four years. This

rapid increase in distribution is illustrated on maps, and both it and the factors that favoured it are discussed.

Bishop (J. L.) & Burkhardt (C. C.). **Effects of malathion and parathion on ejection of young from gravid female spotted alfalfa aphids.**—*J. Kans. ent. Soc.* **32** no. 1 pp. 35–36, 2 refs. Manhattan, Kans., 1959.

Since some aphids have been found to be stimulated to reproduce by treatment with insecticides [*cf. R.A.E.*, A **34** 143; **35** 400], gravid females of *Therioaphis maculata* (Buckt.) were sprayed with parathion at 1 or 2 oz. or malathion at 4 or 8 oz. per acre in a box or on lucerne and observed for mortality and reproduction. All the aphids died within a few hours and none reproduced. The same result was obtained when the aphids were sprayed in the box and transferred to unsprayed plants after 10–20 minutes.

Wakeland (C.). **Mormon crickets in North America.**—*Tech. Bull. U.S. Dep. Agric.* no. 1202, [2+] 77 pp., 19 figs., 1 fldg. map, 229 refs. Washington, D.C., 1959.

The name Mormon cricket is properly restricted to *Anabrus simplex* Hald., but three other species, *A. cerciata* Caudell, *A. longipes* Caudell and *Peranabrus scabricollis* (Thos.), which also cause serious damage from time to time to crops and other plants in the United States, are here included under it. The author reviews records of these Tettigoniids in the United States and in Canada, where all but *A. cerciata* also occur, and gives information, largely from the literature, on their bionomics, ecology and food-plants, on the damage that they cause, on the outbreaks that have occurred and on their natural enemies and control [*cf. R.A.E.*, A **34** 25; **39** 269]. In 1938, at the peak of the last outbreak, nearly 19 million acres in 11 western States were infested. Control was actively practised, and the economically infested area had been reduced to 116,000 acres in five States by 1948. Populations subsequently increased somewhat, owing to relaxation of control, and about 28 counties in eight States were infested in 1956.

Gaines (R. C.). **Ecological investigations of the boll weevil, Tallulah, Louisiana, 1915–1958.**—*Tech. Bull. U.S. Dep. Agric.* no. 1208, [1+] 20 pp., 11 refs. Washington, D.C., 1959.

The following is virtually the author's summary of this review of investigations on the ecology of *Anthonomus grandis* Boh., an important pest of cotton, carried out in Louisiana between 1915 and 1958. Records of winter survival in Spanish moss [*Tillandsia usneoides*] were made in 1916–40 and in ground trash in 1937–58. Temperatures below 20°F. were fatal to most of the weevils hibernating in Spanish moss [*cf. R.A.E.*, A **42** 92]. Survival in ground trash was more closely related to the number of weevils in the field during May and June. Hibernation cages did not provide a reliable estimate of winter survival [*cf.* **48** 305]. High correlations between winter temperatures, weevil survival, summer rainfall and cotton yields were found. The weevil was more tolerant to calcium arsenate late in the season than earlier. Records of 690 overwintered weevils during 1954–58 showed that some lived longer than 383 days. Flight screen studies showed that 8-mesh hardware cloth, coated with a mixture of adhesive with 37·5 per cent. castor oil, on a stationary wooden frame, the bottom of which was 3 ft. from the ground, provided a satisfactory method for

collecting *A. grandis* and other insects in flight. Screen direction had little effect on the total number of insects caught. Studies with revolving screens that faced the wind at all times showed that more weevils were taken on the leeward side. A greater number of insects was taken on screens 3 ft. above the ground than at greater heights. The weevils became active during the hibernation period and took flight when the temperature reached or exceeded 62° F. Chemotropic studies of trimethylamine and ammonium hydroxide on flight screens indicated that these chemicals had some attraction for *A. grandis* in the absence of cotton.

Chapman (A. J.), Noble (L. W.), Robertson (O. T.) & Fife (L. C.). **Survival of the pink bollworm under various cultural and climatic conditions.**—*Prod. Res. Rep. U.S. Dep. Agric.* no. 34, ii+21 pp., 12 refs. Washington, D.C., 1960.

Pectinophora gossypiella (Saund.), which occurs on cotton throughout Texas, New Mexico and Oklahoma, overwinters as larvae in the seeds in open bolls or in cocoons spun on the soil; other larvae remain in fallen blooms. Studies were made of the survival of overwintering larvae under various cultural and climatic conditions in Texas and Oklahoma [*cf. R.A.E.*, A **46** 440], and the following is based on the authors' summary of the findings.

In experiments at Brownsville, Texas, larvae in free cocoons pupated and gave rise to moths before the latter could infest the next crop. Experiments at Presidio, El Paso, Waco and Port Lavaca, Texas, showed a much lower winter survival in cocoons than in bolls and indicated that survival of the autumn cocoon population is of minor importance in areas of heavy rainfall. In experiments at Presidio, the survival was nearly three times as great in a heavy clay soil as in sandy soil. In other experiments there, winter irrigation decreased survival. Survival decreased with depth of burial, the percentages averaging 15·1, 6·5 and 3·1 at 2, 4 and 6 in., respectively.

Experiments at widely separated localities in Texas and one in Oklahoma showed that winter cultural practices influenced survival and that this effect varied in different localities and was due largely to climatic conditions. Autumn burial of infested bolls decreased survival more than spring burial, except in a dry climate when winter irrigation was not applied. The highest survival occurred in bolls that remained on the soil surface throughout the experiments at all localities except in the subtropical climate of Brownsville, where the highest survival occurred in bolls exposed above the ground, as on standing stalks. Where the temperature dropped to 15° F. or lower, the lowest survival occurred in bolls exposed above the ground until they were buried in the spring.

Highly effective control was obtained in the lower Rio Grande Valley by a programme requiring cotton to be sown between 1st February and 31st March and stalks to be destroyed by 31st August. Experiments showed that survival of the winter population increased greatly with delay in stalk destruction.

Many moths that develop from overwintered larvae die before cotton squares become available for reproduction, and the amount of such emergence increases with delay in sowing. A wide range in sowing dates, from extremely early to late in a given locality, increases the seasonal build-up and the overwintering population. The sowing period should be determined on a district basis; it should not begin until the optimum time, which is the approximate date at which the soil temperature becomes favourable for rapid germination and seedling growth, and should be concluded as soon as possible thereafter.

Experiments in bioclimatic cabinets indicated that *P. gossypiella* can survive an average winter throughout the cotton belt of the United States. Irrigation or heavy rainfall in autumn and winter is conducive to low survival, and a dry spring, resulting in lack of soil moisture to stimulate pupation, may decrease it still further.

Larvae were found to survive at fluctuating temperatures with a minimum below 0°F. at El Paso, where the daily maximum winter temperatures usually rise above 50°F., except for extremely cold periods that last for only a few days. Data obtained in other climates indicated that high mortality resulted not only from extreme low temperatures, but also from long periods with daily maximum temperatures of about 40°F.

In the autumn, mortality in green bolls is negligible if light frosts persist for several days before the onset of sub-freezing temperatures, whereas a sudden drop sufficient to freeze succulent bolls results in almost complete mortality.

P. gossypiella is known to breed in the United States on plants of 38 species other than cotton, and the larvae were found to overwinter in the seed pods of 26 of them. Okra [*Hibiscus esculentus*] is preferred next to cotton and must be classed with it as regards overwintering populations and quarantine regulations.

Drooz (A. T.). **The larch sawfly, its biology and control.**—*Tech. Bull. U.S. Dep. Agric.* no. 1212, iii + 52 pp., 13 figs., 118 refs. Washington, D.C., 1960.

The following is based on the author's summary. Field and laboratory studies on the bionomics and control of *Pristiphora erichsonii* (Htg.) were carried out in northern Minnesota in 1949–56. This sawfly is the most destructive defoliator of larches (*Larix*) in North America and has killed vast quantities of trees since it was first found in 1880. The current outbreak began about 1945. Reproduction is parthenogenetic, and fewer than 2 per cent. of the adults reared were males. Emergence begins about the third week in May during periods of warm weather and is completed by the first week in July; in cooler weather, the adults appear between the first week in June and late July. There is usually only one generation a year, but occasional second-generation adults have been reported. Fecundity is affected by the quality and quantity of the food. During the early years of an outbreak, a female may produce about 100 eggs, but production may average only 50 per female after five years of heavy defoliation. The eggs are laid in rows in the soft cortex of the developing twigs. They hatch in about a week, and the larvae feed on the leaves of the spur shoots for 17–24 days, until the fifth instar is completed, when they drop to the ground and spin cocoons in the duff, in which they overwinter. Fresh cocoons were found during the third week of June when the spring temperatures were above normal, and during the first week in July under cooler conditions. Pupation generally occurs in the following spring or early summer, but some individuals spend two or more winters as prepupae.

Seasonal egg, larval, and frass distribution was investigated in study areas in 1952–55. Although oviposition might begin at the same time, egg and larval development was more rapid on dry sites than on wet ones. Defoliation occurs chiefly during June and July, and an early result is impairment of tree growth. The extent of defoliation depends on many factors and frequently varies between trees in a stand and between neighbouring stands. Some of the factors responsible are the accumulation of water on the swamp surface at the time when the larvae are leaving the trees or the adults

are emerging, the past history of defoliation as it relates to the production of new shoots for oviposition, and the lack of food if tree mortality becomes widespread. The inability to predict new shoot production precludes a forecast of defoliation from the size of the cocoon population [*cf. R.A.E.*, A **48** 143]. Loss of radial increment occurs after defoliation for 4–6 years, and was generally greater than 65 per cent. by 1955, and tree mortality sets in after 6–9 years. Mortality became apparent in the north-eastern uplands of Minnesota in the autumn of 1954, and was observed in scattered pockets in the better swamp sites of the north-central area in the summer of 1956.

Of the 29 reported parasites of *P. crichsonii*, only two have been common at any time during the outbreak. The imported Ichneumonid, *Mesoleius aulicus* (Grav.) (*tenthredinis* Morl.), once a very important control factor, has been reduced to minor status by a host immunity reaction [*cf.* **42** 156]. *Ptychomyia* (*Bessa*) *selecta* (Mg.) increased in importance, but the past history of this Tachinid does not indicate that it will play a major part in the decline of the outbreak. The Pteromalid, *Tritneptis klugii* (Ratz.), has not been found in Minnesota since 1949 and can therefore not be depended upon for control. Various arthropod predators have been reported, but nothing is known as to their effect on the sawfly population. Laboratory tests with nematodes resulted in complete host mortality, but field-test recoveries were poor. Three genera of entomophagous fungi and two species of *Bacillus* were cultured from larvae. Vertebrate predators eliminate part of the sawfly population, and rodents are the most important of these, probably destroying about 80 per cent. of the overwintering cocoons. In addition, some mortality is caused by wind, surface water in the swamps, exposure to summer sunlight, and high temperatures. The problems of ground and aerial insecticide applications are discussed, and spray recommendations based upon field and laboratory tests [*cf.* **46** 391] are given.

Glick (P. A.). **Collecting insects by airplane, with special reference to dispersal of the potato leafhopper.**—*Tech. Bull. U.S. Dep. Agric.* no. 1222, [1 +] 16 pp., 2 figs., 4 refs. Washington, D.C., 1960.

The following is virtually the author's summary. In a study of the movement of the potato leafhopper, *Empoasca fabae* (Harris), a series of airplane insect-collecting flights was made at altitudes of 100–5,000 ft., from 8th May to 4th June 1957, covering areas in north-eastern Louisiana along the Mississippi River into Mississippi and Arkansas, and then into central and northern Illinois and Indiana. During the 52 flights made, 2,528 insects were collected, representing 94 families, 202 genera and 123 identifiable species. Of the 28 examples of *Empoasca* spp. taken, 21 were *E. fabae*, which was collected at altitudes of 200–4,000 ft. These collections supported other data obtained by the Illinois Natural History Survey, indicating a definite pattern of dispersal and migration of the insect to the north-central States from the Mississippi Delta [*cf. R.A.E.*, A **46** 347].

Roberts (D. W. A.). **Sawfly resistance in wheat. III. Changes in resistance during the development of the wheat plant.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 7–20, 1 graph, 11 refs. Ottawa, 1960.

The following is largely the author's abstract of this part of a series [*cf. R.A.E.*, A **46** 389, etc.]. Quantitative data obtained in Canada in field

and greenhouse experiments in 1950–53 with wheat of the seven varieties previously used [*cf.* **44** 272] showed that resistance to attack by *Cephus cinctus* Nort. depended on the stage of development of the plant at oviposition. The plants were usually most heavily infested for a part or all of the period from one week before the shot-blade stage to one week after the flowering stage. Wheat of the variety Rescue, the two varieties of *Triticum durum* and the two hybrids, all of which are resistant, lost their resistance to the development of the eggs and first-instar larvae some time between the shot-blade stage and flowering. The two susceptible varieties did not show this type of resistance. The mortality of the older larvae increased in plants infested towards maturity. The time at which this increase began depended on the variety involved and ranged from just before the shot-blade stage to just after flowering.

Holmes (N. D.) & Peterson (L. K.). **The influence of the host on oviposition by the wheat stem sawfly, *Cephus cinctus* Nort. (Hymenoptera: Cephidae).**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 29–46, 6 figs., 13 refs. Ottawa, 1960.

The following is based on the authors' summary. The extent to which the relative times, amounts and sites of oviposition by *Cephus cinctus* Nort. are influenced by the variety and rate of development of wheat plants was investigated in field experiments in Alberta in 1953–55 and 1957–58 with four varieties of bread wheat, *Triticum aestivum (vulgare)*, and two of *T. durum*. All three were found to be largely determined by differences in plant development [*cf.* preceding abstract]. Resistance to oviposition was not a factor in sawfly resistance of any of the varieties.

Duncan (J.) & Généreux (H.). **La transmission par les insectes de *Corynebacterium sepedonicum* (Spieck. & Kott.) Skaptason et Burkholder.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 110–116, 4 refs. Ottawa, 1960.

As *Corynebacterium sepedonicum*, the causal agent of bacterial ring-rot of potato, was experimentally transmitted by *Leptinotarsa decemlineata* (Say) and other insects in preliminary tests [*cf. R.A.E.*, A **31** 114], its transmission by insects associated with potato foliage was further investigated in the glasshouse in Quebec. The following is based largely on the authors' summary of the results. The experiments confirmed the ability of *L. decemlineata* to transmit *C. sepedonicum* and showed that it can also be transmitted by means of *Epitrix cucumeris* (Harris), *Lygus lineolaris* (P. de B.), Cicadellids (notably *Macrosteles fascifrons* (Stål)), aphids (notably *Myzus persicae* (Sulz.)) and Cercopids. Infection was induced by inoculating the roots of healthy potato plants with suspensions of pulverised insects that had fed for 3–4 days on infected plants or of macerated healthy leaves or young plants on which infected insects had fed for 4–5 days. It also occurred under cage conditions when the insects (excluding aphids) moved freely from a diseased to healthy plants. Potato plants infected by all the insects, though less frequently in the case of *E. cucumeris*, produced some tubers that were infected, though they were without external symptoms. Only two plants, both infected by *L. decemlineata*, produced tubers that gave rise to stems showing symptoms of the disease.

Perron (J. P.) & Lafrance (J.). **Control of the onion maggot, *Hylemya antiqua* (Meig.) (Diptera: Anthomyiidae), with insecticides in organic soils of southwestern Quebec.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 156–159, 7 refs. Ottawa, 1960.

The following is largely the authors' abstract of the results of experiments on seed and soil treatments with chlorinated hydrocarbons for the control of *Hylemyia antiqua* (Mg.) on onion, carried out on organic soils in southwestern Quebec in 1955–58. Dieldrin, heptachlor and endrin as wettable powders mixed with the seed at 1 oz. toxicant per lb. were highly effective in protecting the plants. Treatment with heptachlor appeared to stimulate plant growth. Toxaphene applied in the same way gave poor protection, and Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate), though effective, reduced germination by one-third. Treatment of the soil surface with chlordane dust at 4·5 lb. toxicant per acre before sowing gave fair protection where seed had not been treated, but aldrin or heptachlor in an emulsion and an aldrin dust similarly applied to the surface and the aldrin emulsion applied to the soil as a drench along the plant rows did not. Combinations of dieldrin or DDT as seed dressings with chlordane or aldrin applied to the soil surface when the plants averaged 2 in. in height were not more effective than a seed treatment alone.

Raine (J.) & Andison (H.). **Chemical control of the raspberry root borer, *Bembecia marginata* (Harr.), on loganberry in British Columbia.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 160–164, 1 pl., 4 refs. Ottawa, 1960.

The following is substantially the authors' summary of the results of experiments carried out in southern Vancouver Island in 1955–58. A drench prepared from an emulsifiable concentrate containing 25 per cent. diazinon and applied to the crowns of loganberry plants in March, April or October against early-instar larvae of *Pennisetia* (*Bembecia*) *marginata* (Harris) reduced a severe infestation (of 77 per cent. or more of the crowns) to 4 per cent. or less. This excellent control was obtained at rates as low as 2 pints concentrate per 100 gal. and 0·5 pint drench per plant (43 gal. per acre). Applications in May at 2 pints per 100 gal. and 2 pints drench per crown reduced the infestation to 10 per cent. Infestation was reduced to between 0 and 10 per cent. by emulsifiable concentrates of lindane (almost pure γ BHC), phorate (Thimet) and 12008 (O,O-diethyl S-isopropylthiomethyl phosphorodithioate) applied at 5, 1 and 1 pint per 100 gal., respectively, and a rate of 1 pint drench per crown in October, and by similar concentrates of Sevin, dimethoate (NC262) and Phosdrin applied at 8, 0·5 and 1 pint per 100 gal., respectively, and a rate of 2 pints drench per crown in April. The drenches apparently killed the early-instar larvae, which overwinter in hibernacula at the base of the canes until early April and feed just beneath the bark in May, and thus prevented damage to canes that would bear fruit the following year.

Banham (F. L.). **Soil insecticides for control of the tuber flea beetle, *Epitrix tuberis* (Gent.), in the interior of British Columbia.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 165–171, 12 refs. Ottawa, 1960. **Sprinkler irrigation as a means of applying soil insecticides for controlling the tuber flea beetle, *Epitrix tuberis* (Gent.), in the interior of British Columbia.**—*T.c.* pp. 172–177, 5 refs.

Experiments on the control of *Epitrix tuberis* Gentner on potato were carried out in the Kamloops area of British Columbia between 1951 and

1955, and the following paragraphs are based on the author's abstracts of these two papers, respectively, in which the results are recorded.

Single treatments with aldrin, chlordane, dieldrin or heptachlor in emulsion concentrates applied at 4, 7·5, 1·5 and 3 lb. toxicant per acre, respectively, before or soon after planting and immediately incorporated into the soil to a depth of 2–4 in. [*cf. R.A.E.*, A **47** 127] by disking or harrowing were highly effective and more reliable, economical and convenient for controlling *E. tuberis* than six foliage applications of DDT dust at 1 and 1·5 lb. toxicant per acre. They also controlled wireworms, and larvae of *Lachnosterna* (*Phyllophaga*) *anxia* (Lec.), *Euxoa ochrogaster* (Gn.) [*cf.* **46** 388], *E. messoria* (Harris) and other Melolonthids and Noctuids. The first three likewise gave good results when similarly applied to the soil in dusts.

An emulsion concentrate of dieldrin applied through sprinkler irrigation systems at 2 or 2·5 lb. toxicant per acre and incorporated into the soil by disking or harrowing effectively reduced damage by *Epitrix*. Similar treatments with aldrin at 4 lb. per acre were much less effective. Colorimetric and bioassay analyses indicated that mechanical incorporation was necessary because no appreciable amount of toxicant penetrated below the top inch of soil even when a large amount of irrigation water was applied. In view of this necessity, the method is of doubtful usefulness, since the insecticide could not be incorporated into the soil for many hours after irrigation (on some soils for as many as 72), and its exposure to high summer temperatures for so long would be undesirable.

Burrage (R. H.). **Insecticide row treatments for the control of wireworms in potatoes.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 178–182. 6 refs. Ottawa, 1960.

The following is almost entirely the author's abstract of this account of experiments carried out in Saskatchewan in 1954–56 on soils of different types infested with wireworms, comprising *Ctenicera aripennis destructor* (Brown), which represented 68, 26 and 39 per cent. of the population in the three years, respectively, *Hypolithus bicolor* Eschscholtz and, in 1956, *Limonius* and *Aeolus* spp., which together represented 28 per cent. of the population. In field plots of potatoes, in which, when untreated, about 20 per cent. of the tubers were damaged by wireworms, not more than 5 per cent. were damaged after band treatments with aldrin or heptachlor applied in dusts, granules or impregnated fertilisers at 1 or 3 lb. toxicant per acre during planting. At least 15 per cent. of the tubers were damaged after band treatments with chlordane dusts at the same rates. Damage after treatment with aldrin or heptachlor dusts applied in the open furrow by hand immediately before planting was similar to that after band treatments at the same rates. Where about 40 per cent. of the tubers were damaged in untreated plots, 9 and 15 per cent. of the tubers were damaged after band treatments with aldrin and heptachlor granules, respectively, each at 3 lb. toxicant per acre; 23 and 28 per cent. of the tubers were damaged after band treatments with the same insecticides at 1 lb. per acre. Thus, the treatments reduced damage enough to bring the potato crop to top table-stock grade, without culling, only where potential damage was light. None of the treatments reduced wireworm numbers by more than 75 per cent., and none resulted in increased yields. Furrow treatments with aldrin and heptachlor dusts reduced the yield in one of two tests, presumably because of phytotoxic effects.

Putman (W. L.) & Herne (D. C.). **Effects of Sevin on phytophagous mites and predators in an Ontario peach orchard.**—*Canad. J. Pl. Sci.* **40** no. 1 pp. 198–201, 5 refs. Ottawa, 1960.

The following is substantially the authors' abstract. In experiments in Ontario in 1958, the numbers of *Panonychus ulmi* (Koch) increased but those of *Bryobia arborea* Morgan & Anderson [a mite of the complex of *B. praetiosa* Koch (*cf. R.A.E.*, A **48** 254)] and *Aculus* (*Vasates*) *cornutus* (Banks) decreased after sprays of Sevin at 2 lb. 50 per cent. wettable powder per 100 gal. water had been applied to peach trees. Sevin practically eliminated the predacious mite, *Typhlodromus rhenanus* (Oudm.), and larvae and pupae of *Stethorus punctillum* Weise, and greatly reduced the numbers of adults of *S. punctillum*. Chrysopid larvae and spiders.

Simmonds (F. J.). **Biological control of the coconut scale, *Aspidiotus destructor* Sign., in Principe, Portuguese West Africa.**—*Bull. ent. Res.* **51** pt. 2 pp. 223–237, 3 figs., 2 refs. London, 1960.

The following is largely the author's summary. The coconut scale, *Aspidiotus destructor* Sign., was observed for the first time in the island of Principe in November 1954 [*cf. R.A.E.*, A **47** 415], but was almost certainly present in 1952. Prior to 1954, normal fluctuations had occurred in the annual production of copra, probably correlated mainly with rainfall. However, in 1954 there was a steady and serious decline in production, owing to damage caused by *Aspidiotus*. Several species of endemic natural enemies were found attacking the scale [**47** 416], but the control exerted by them was inadequate to prevent increase. The predacious Coccinellid, *Cryptognatha nodiceps* Mshl., was introduced in August 1955 [**47** 416]. The course of spread of both scale and predator are traced, and the effect of each on the production of copra is shown. There was a considerable time lag between the incidence of heavy scale attack or its control and the effect on yield. Even though complete economic control of the scale had been obtained by July 1957, copra production did not regain its original level until the middle of 1958. *Cryptognatha* also attacked *Pseudaulacaspis pentagona* (Targ.) on papaya in most areas and *Hemiberlesia palmae* (Ckll.) on *Cycas revoluta* in one. No parasitism of larvae or pupae of *Cryptognatha* was observed, although parasites attacked the larvae of other Coccinellids present. Of the other biotic factors that affect copra production in the island, monkeys and rats are the most important; *Ischnaspis longirostris* (Sign.), *Selenaspidus articulatus* (Morg.), *Vinsonia stellifera* (Westw.) and *H. palmae* all infest the leaves, but cause relatively little damage. The complex of Coccids and predators on coconut in Principe is compared with that in San Tomé, where *A. destructor* does not occur and *H. palmae* is the most injurious species on the palms, and the prospects for permanent control of *A. destructor* in Principe are discussed and considered excellent.

Williams (D. J.). **A new species of *Dysmicoccus* Ferris (Pseudococcidae, Homoptera) on banana.**—*Bull. ent. Res.* **51** pt. 2 pp. 239–241, 1 fig. London, 1960.

Dysmicoccus alazon, sp. n., is described from females taken on imported bananas (some known to have come from the Canary Islands) in England and Egypt and from material taken in the Canary Islands, some from cactus (on to which the mealybugs had probably fallen from banana). *D. alazon*

is widespread in the Canary Islands and has hitherto been misidentified as *Pseudococcus comstocki* (Kuw.). It is not known whether it occurs in other banana-growing areas, but the author was informed by W. J. Hall that, over a period of seven years in Egypt, he did not collect it on bananas growing there.

Dunn (J. A.). **The natural enemies of the lettuce root aphid, *Pemphigus bursarius* (L.).**—*Bull. ent. Res.* **51** pt. 2 pp. 271–278, 10 refs. London, 1960.

The following is based almost entirely on the author's summary of this account of observations in central England in 1955–58 on the complex of natural enemies attacking *Pemphigus bursarius* (L.), which inhabits galls on the leaf-stalks of poplar (*Populus*) in spring and lives underground on lettuce during summer [*cf. R.A.E.*, A **48** 351]. Parasites were of minor importance, and only fundatrices were attacked by them. The only species reared was the Pteromalid, *Pachyneuron* sp., which is assumed to be hyperparasitic. When the galls open at migration time, Syrphid larvae and Anthocorids enter and attack the aphids. *Anthocoris nemorum* (L.) and *A. nemoralis* (F.) were the main predators at this stage. Before they begin feeding, they kill all the aphids within a gall, possibly by means of a secretion from the stink glands with a fumigant effect. Several Staphylinids and Carabids, almost certainly predators, were frequently associated with subterranean colonies of *Pemphigus bursarius*, and the latter were commonly attacked by the larvae of the Chloropids, *Thaumatomyia glabra* (Mg.) and *T. notata* (Mg.). The sexuparae were attacked before they left the lettuce plants by *Coccinella septempunctata* L., *C. undecimpunctata* L. and *Adalia bipunctata* (L.) and on their arrival on poplar by the last two of these and the Anthocorids.

Tapley (R. G.). **The white coffee borer, *Anthores leuconotus* Pasc., and its control.**—*Bull. ent. Res.* **51** pt. 2 pp. 279–301, 1 pl., 3 graphs, 40 refs. London, 1960.

The following is based mainly on the author's summary of this account of work on the bionomics and control of *Anthores leuconotus* Pasc., in Tanganyika, where this Lamiid, which is indigenous in most territories in Africa south of about latitude 5°N., is an important ring-barking and wood-boring pest of the main stem and root of arabica coffee (*Coffea arabica*).

The life-cycle occupies 12–25 months, most individuals requiring 16–20. Adults from eggs laid during the long rains (April–June) of one year will thus mostly emerge during the short rains (November–January) at the end of the following year, with some appearing during the preceding and some during the ensuing rains. Where the mean life-cycle occupies 18 months, the egg stage lasts 21–23 days, larvae in the first five instars ring-bark the tree for four months and those in the final two instars bore into the wood for 12 months, the pupal stage lasts about 4½ weeks, and the adults remain in the tree for two weeks before emerging. Oviposition takes place mainly between sundown and midnight and is described. The larvae grow more rapidly while feeding on soft tissues (ring-barking) than on hard ones (wood-boring). The mean weekly increases in width of the head capsules of larvae in the two stages were 0·12 and 0·033 mm., respectively. A method of

observing wood-boring larvae in their burrows is described. Female pupae, with a mean weight of 1·23 g., were significantly heavier than male pupae, with a mean of 0·99 g. Male and female beetles were found in about equal numbers in the field, but males emerged from the trees slightly earlier than females. At the warmer, lower altitudes, the larvae are found mostly in the base of the stem and main root system, but at higher, colder altitudes, and also in heavy shade, more live well above ground level.

Larval mortality appears to be high, perhaps as much as 75 per cent. Five species of Hymenoptera are believed to parasitise the ring-barking larvae, and three Ichneumonids, *Afrocoelichneumon didymatus* (Morl.), *Cratichneumon* sp. and a *Nadia* sp. near *ruficeps* (Cam.) parasitise the wood-borers. A few of the eggs are parasitised by the Eulophid, *Aprostocetus* sp. Loss of crop due to *Anthores* in one plot in which infestation was light and not continuous was estimated at 0·4 cwt. clean coffee per acre per year. Where infestation is heavy and continuous, the loss is certainly much higher. Wild food-plants of the Lamiid are listed, and their importance is discussed. *Coffea arabica*, *C. liberica*, *C. eugenioides* and *Lachnastoma khasianum* are the only known species of coffee infested. If robusta coffee (*C. canephora*) is attacked, the bark splits open and the eggs are exposed.

Earlier control measures [*cf. R.A.E.*, A **28** 145; **34** 103; **40** 254, etc.] are reviewed and considered unsuitable for modern conditions. Experiments since 1950 on the effectiveness of various insecticides and methods of application are described [*cf.* **44** 191, 210; **46** 367]. A spray containing 0·5 per cent. dieldrin in emulsified solution applied at the rate of 18 gal. per acre (540 trees) to the lower part of the stems gave excellent protection from *A. leuconotus* and persisted effectively in the bark for up to 27 months. This method of control has accordingly been adopted. Methylene blue is included in the mixture to warn operators of the presence of dieldrin on skin or clothing and to improve spraying efficiency. The insecticide is best applied in November; mature trees need treatment once a year for the first two years and subsequently every second year, and young trees should be re-treated each year until the main stem reaches full size. By 1958, *A. leuconotus* had been reduced to insignificant numbers wherever this measure had been applied. The persistence of dieldrin and its action against *A. leuconotus* are discussed.

GRIFFITHS (D. C.). **The behaviour and specificity of *Monoctonus paludum* Marshall (Hym., Braconidae), a parasite of *Nasonovia ribis-nigri* (Mosley) on lettuce.**—*Bull. ent. Res.* **51** pt. 2 pp. 303–319, 2 pls., 4 figs., 16 refs. London, 1960.

The following is based mainly on the author's summary. A survey of the parasites of aphids that occur on lettuce was made in central England in 1953–54 and in northern England in 1958, and the species found are listed, with their hosts. The most numerous was *Monoctonus paludum* Marshall, which was reared only from *Myzus* (*Nasonovia*) *ribis-nigri* (Mosley); this Braconid is stated in a foot-note to be considered by Starý a synonym of *M. crepidis* (Hal.), which has been recorded from other aphids on plants related to lettuce. Its host relations were investigated, with special reference to *M. ribis-nigri* on lettuce, and techniques for observing its behaviour towards aphids and methods of determining its breeding success in species other than *M. ribis-nigri* are described. The oviposition behaviour of the parasite differed from that recorded for other Aphidiines in that it

holds its host with its forelegs and inserts its ovipositor for a period lasting some 15 seconds. It did not normally attack aphids taken from plants unrelated to lettuce, and attacks on aphids that were already parasitised or that had been dead for some time were also rare. Aphids 1–2 mm. in length were the most suitable, and the parasite experienced difficulty in ovipositing in larger or smaller hosts. The hampering effect of the waxy covering that occurs on the cuticle of certain species is described. Permanent records of the presence of parasite eggs within the hosts were obtained by photographing aphids of which the body contents had been cleared by a method described. The parasite oviposited in all the species of lettuce aphids offered to it, but the eggs completed their development only in *M. ribis-nigri*. The probability that it lays eggs in species of lettuce aphids other than *M. ribis-nigri* under natural conditions is considered, and the results of the work are reviewed in relation to earlier studies of a similar nature [*cf. R.A.E.*, A **24** 548; **27** 35].

Walker (P. T.). **Insecticide studies on the maize stalk borer, *Busseola fusca* (Fuller), in East Africa.**—*Bull. ent. Res.* **51** pt. 2 pp. 321–351, 5 graphs, 19 refs. London, 1960.

The following is based almost entirely on the author's summary. Trials carried out in Tanganyika in 1955–57 are described to show that the time taken for first-instar larvae of *Busseola fusca* (Fuller) to reach the more closely packed young leaves in the central axis of maize plants is about ten days and that insecticides are effective up to the end of this period [*cf. R.A.E.*, A **37** 230]. Results show that the best time for the application of control measures is as near to the hatching of the eggs as possible, but economic control is possible for up to five days later with the more persistent insecticides, such as endrin. A method of testing insecticides as residual deposits, by allowing first-instar larvae to walk on them, is described, and it showed that isodrin, DDT, endrin and γBHC are highly effective as residual films, the LD50's for contact for one minute being 1·8, 4·7, 8·3 and about 20 mg. per sq. metre, respectively. Derris emulsion had no residual effect after drying and was effective in the liquid state only after contact with larvae for several minutes.

In the trials, increases in yield of up to 2·6 times the control yields were shown to be possible; they averaged twice the control yield. Endrin was the most consistently effective insecticide, applied at 2 per cent. in a dust or at 0·03–0·04 per cent. in an emulsion spray. Two applications at an interval of two weeks were effective, but three applications of an emulsion spray containing 0·05 per cent. DDT at nine-day intervals were more effective than two, while one may be of little value. An application of DDT at 2·5 oz. per acre can be effective for 7–10 days, while endrin at 1·5 oz. per acre can be effective for 14 days. In general, rates per application should not fall below 3·5 oz. DDT or 2 oz. endrin per acre, overall. The superiority of a 5 per cent. DDT dust over one of 2·5 or 1 per cent. makes it more economical in a high-yielding, heavily attacked area. Diazinon and malathion in emulsion sprays are less persistent than DDT. Trials with malathion in a 4 per cent. dust and a 0·15 per cent. emulsion spray were inconclusive on account of heavy damage by *Spodoptera* sp. Attempts to increase the persistence of malathion and γ BHC by the addition of chlorinated terphenyl resins [*cf.* **44** 117, 243] were also inconclusive, but DDT in an emulsion spray appeared more effective with than without resin. The economics of successful control at the prices obtaining are discussed for the various trials. Chemical estimation of the

deposits of insecticides retained on the plants showed that between 1·4 and 3·7 per cent. of the quantity applied per unit area can be recovered. In a discussion of the significance of the results in control, it is suggested that spraying the stems only is half as effective as spraying the whole plant.

Two aerial spray trials in Kenya in 1953 with DDT in an emulsion and a suspension spray, of which the results were inconclusive although partial control was obtained, are also recorded. The place of control of *Busseola* in agricultural practice is described, and results are quoted to show that yields can be increased by good farming as much as by control of *Busseola*.

Milne (A.). **Biology and ecology of the garden chafer, *Phyllopertha horticola* (L.). VII. The flight season: male and female behaviour, and concluding discussion.**—*Bull. ent. Res.* **51** pt. 2 pp. 353–378, 2 figs., 8 refs. London, 1960.

The following is based on the author's summary of this part of a series on the bionomics of *Anomala* (*Phyllopertha*) *horticola* (L.) in the English Lake District [*cf. R.A.E.*, A **48** 56, etc.], which deals with the behaviour of the adults and completes the appraisal of the flight season. In phase 1 [*cf.* **47** 47], swarming is essentially a male activity in which weaving in flight close over the ground alternates with alighting to seek emerging females. The females perambulate slowly on the ground, where they are heavily outnumbered [*cf.* **47** 165] and tend to be quickly immobilised by the males. Swarming is confined to the areas of sward from which the beetles emerge. Mechanisms involved in the siting and coherence of swarms are suggested. Pairing, which is repeated, depends almost entirely on chance physical encounters, and most females are discovered within a minute of leaving the soil. Those that have not yet laid 70–100 per cent. of their eggs pair in the sward and then burrow vertically downwards; the males ascend to the surface and search for another female. The average distance between the points at which a female emerges from and re-enters the soil is little more than 7 in., with an observed maximum of 29 in., and most of the eggs are therefore deposited close to where the female developed as a larva. Females that have laid 70–100 per cent. of their eggs mate above ground and within an hour enter phase 2 by flying to the nearest bracken or trees, where they mate again and begin to feed [**47** 47].

In phase 1, females may emerge from and re-enter the soil several times, but do so only once on any one day. They oviposit at any time from a few hours to 15 days after primary emergence, but first emerge from and re-enter the soil 1–8 times, including the primary emergence. Oviposition is completed by the end of 2–17 days after primary emergence. The eggs are laid in 1–4 batches, each over a period of 1–8 days, and between batches the females emerge from the soil 1–6 times. They lay in all about 80 per cent. of their total complement of fully formed eggs. Females that are not discovered by a male within about four minutes of leaving the soil in hot, sunny weather begin to fly and may appear on bracken or trees before beginning or, more often, before completing, oviposition; these females constitute the bulk of effective 'bee-liners' [*cf.* **48** 56] (those that actually oviposit). The males rarely return to the soil after primary emergence, but remain at the base of the sward for about a week, after which they migrate to bracken or trees and begin to feed.

Swarming on bracken and trees in phase 2 is essentially the same as on the grass sward in phase 1, but more females are present, they fly more, and pairing takes place on the foliage. Throughout phase 2, some individuals

fly away from the swarm on bracken or trees, the males, which alight nearby on the sward, in low arcs and the few females (' bee-liners ') with high bullet-like flight. About 90 per cent. of ' bee-liners ' have one or more eggs still unlaid, and about half of them fly out of their home field, the maximum distance traversed exceeding at least a quarter of a mile; they seem to exercise some discrimination with regard to type of soil or sward, or both, for completing oviposition. Effective ' bee-liners ' comprise 19–24 per cent. of all females; on the average they lay 8–10 eggs each. Apart from the greater male activity, the habits of the two sexes are largely similar in phase 2 and comprise crawling, flying, mating, feeding and resting on the bracken or trees, but whereas females arrive on and leave the bracken or trees throughout phase 2, the males have all arrived and their departures have virtually ceased at the end of phase 1. Nearly all males (excluding those eaten by birds) and most females die on the bracken and trees, but many females die in the soil after completing oviposition.

It is concluded that the grosser features of the flight season, comprising the two overlapping phases lasting about 26 days in all for a homogeneous population, result from the occurrence of primary emergences over the first 12–13 days and the migration of the average individual from the sward about halfway through its survival period of 13–14 days. Other features, comprising the proportions of the two sexes and the reproductive state of the females present in the swarms of the two phases and in the traffic between them, result from the occurrence of the phases combined with slight male precedence in primary emergence, variation in reproductive development of females at primary emergence and wide differences in habits and behaviour of the sexes. The flight season is important ecologically because behaviour at that time affects spatial and time distribution.

Miscellaneous matters connected with behaviour that were referred to in earlier parts of the series are briefly explained in an appendix.

De Lotto (G.). **The green scales of coffee in Africa south of the Sahara (Homoptera, Coccidae).**—*Bull. ent. Res.* **51** pt. 2 pp. 389–403, 6 figs., 16 refs. London, 1960.

The following is based partly on the author's summary. The identity of the Coccids from Africa recorded as *Coccus africanus* (Newst.) and *C. viridis* (Green) is reviewed in detail, and both these species are redescribed. *C. africanus*, which was hitherto thought to be widespread in Africa south of the Sahara, appears to be confined to Nigeria, where it attacks coffee. Some previous records of *C. viridis* south of the Sahara are erroneous, but authentic material was seen from Kenya on coffee, *Citrus* and *Plumeria acutifolia*, Zanzibar on coffee and *Croton* sp., Tanganyika and Uganda on coffee, the island of Principe on coconut, Nigeria on *Citrus*, Ghana on *Rauwolfia vomitoria* and Sierra Leone; it is not regarded as an important pest in East Africa. Both *C. africanus* and *C. viridis* have been recorded in error for *C. aethiopicus* De Lotto [*cf. R.A.E.*, A **6** 86], which attacks *Citrus* in South Africa. Four other species of green scales attacking coffee are described as new. These are *Coccus alpinus*, which has been confused with *C. africanus* for more than 40 years, from Kenya, Tanganyika, Uganda and the Belgian Congo and also from Eritrea, where it is recorded only from lemon and *Carissa edulis*; *Coccus celatus*, which has been confused with *C. viridis*, and *C. consimilis*, both from Uganda; and *C. viridulus*, from Kenya. A key to the six species that attack coffee is included.

Long (D. B.). **Larval movement and infestation in the wheat bulb fly, *Leptohylemyia coarctata* (Fall.).**—*Bull. ent. Res.* **51** pt. 2 pp. 405–414, 3 figs., 4 refs. London, 1960.

The following is based almost entirely on the author's summary. In pot experiments in England, the ability of newly hatched larvae of *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) to move through 9 in. of soil and infest wheat plants [*cf. R.A.E.*, A **34** 368; **47** 364] was tested in sandy loam, clay loam and peaty loam and also in clay loams of different acidity. A group of 200 newly hatched larvae was introduced into each type of soil, and the effects were measured by the numbers of larvae subsequently recovered from infested plants. The percentages recovered for sandy loam, clay loam and peaty loam were 28, 19 and 2, respectively. The larvae infested plants grown in clay loam ranging in pH from 4·9 to 7·8, and the results suggested a possible optimum at pH 6·2, the value found for the sap of wheat shoots. The relative failure to infest in peaty loam appeared to be due rather to hindrance of larval movement than to an interference with the mechanism of plant location. In experiments in plots 7 ft. square, into each of which 100 newly hatched larvae were introduced, no predominating direction of movement was observed. The larvae travelled for up to at least 21 in. before they entered a shoot, and they spent up to 75 per cent. of their development period in this shoot, their weight increasing about 60 times. Additional distances were travelled when larvae left the first shoot to find another. This later movement tended to take place along rows. In subsequent feeding, larval weight increased by a further factor of 15. The larvae damaged an average of two shoots each and travelled a maximum distance of 33 in., measured in a straight line, throughout their life.

Kriegler (P. J.). **Notes on the occurrence of fruit-sucking moths on deciduous fruits in the winter rainfall region.**—*S. Afr. J. agric. Sci.* **1** no. 3 pp. 245–247, 5 refs. Pretoria, 1958. (With summaries in French & Afrikaans.)

The following is taken from the author's summary. Observations carried out during the past few seasons showed that there are at least 13 species of fruit-sucking moths attacking peaches in the winter rainfall region of South Africa. *Serrodes partita* (F.) (*inara* (Cram.)) was the predominant species observed. *Achaea lienardi* (Boisd.) was more sporadic in occurrence, and the others were still less common.

Schedl (K. E.). **Insectes nuisibles aux fruits et aux graines.**—*Publ. Inst. nat. agron. Congo belge* Sér. sci. no. 82, 133 pp., 50 figs., 2 refs. [Brussels] 1960.

An attempt is made to list all the insects that live in the seeds or fruits of forest trees and cultivated plants in the field in tropical Africa. The list is divided into two main parts, the first showing the insects and the plants attacked by them, and the second showing the plants, the countries concerned, and the insects, with indications of locality, habitat, parasites, and economic importance. By far the greatest part of the information relates to the Belgian Congo.

Mayné (R.) & Donis (C.). **Hôtes entomologiques du bois. I. Espèces relevées à Yangambi après abattage.**—*Publ. Inst. nat. agron. Congo belge* Sér. sci. no. 83, 116 pp., 50 refs. [Brussels] 1960.

Records have been kept of the insects found on or in the trunks of forest trees at various times after felling or ringing at Yangambi, in the Belgian Congo, and the main part of this publication comprises a table showing those found associated with trees of 28 species. Termites are excluded. Preliminary sections are concerned with methods and the characters of the trees themselves.

Alibert (H.) & Mallamaire (A.). **Les charançons de la noix de kola en Afrique occidentale française. Moyens de les combattre.**—*Bull. Prot. Vég. A.O.F.* 1956–57 pp. 69–88, 17 figs., 16 refs. Dakar, 1958.

Cola nuts are an important crop in Guinea, the Ivory Coast, Dahomey and other parts of West Africa and are attacked by two weevils, *Balanogastris kolae* (Desbr.) and *Paremydica insperata* Faust [*cf. R.A.E.*, A **46** 407]. Descriptions are given of all stages of the first and all but the egg of the second. *B. kolae*, the life-history of which is described [*cf.* **45** 169], attacks *C. nitida* and *C. acuminata*. The adults pair 2–3 days after emerging, and oviposition begins four days later. The eggs are laid singly in the pulp surrounding the nuts, and the larvae feed in the seeds, forming sinuous galleries. The adults survive for over a month; in captivity, three females laid 60–69 eggs each. Although many nuts are attacked while still on the tree, especially if damaged by other insects or during gathering, the females show a marked preference for fallen ones. Most of the nuts are punctured or infested on arrival at the storehouse, and losses of over 30 per cent. have occurred in one district of the Ivory Coast. Attack continues in the storehouses and during transport. All the stands of *Cola* trees in Africa are probably infested, and spread is facilitated by the traffic in nuts, which has for long extended to central Africa. The larvae and pupae were parasitised by a Braconid of the genus *Atanycolus*, the eggs of which are laid on the larva in its gallery; the parasite larva pupates in 11–12 days. The larvae and pupae are also destroyed by predacious mites. *P. insperata* is less common than *B. kolae*, though the two sometimes occur in the same nut. The damage is similar, but the larval galleries are shorter and wider than those of *B. kolae*. In the Ivory Coast, the egg, larval and pupal stages last 5–6, 19–21 and 6 days, respectively; adults survived in the laboratory for 18–22 days.

In 1938 and subsequently, control by fumigation with methyl bromide under partial vacuum was investigated, and it was found that exposure for one hour to a dosage of 80 oz. methyl bromide per 1,000 cu. ft. gave satisfactory control without harming the nuts. The installation of fixed or mobile equipment for this treatment at the centres handling most nuts was accordingly recommended, and descriptions are given of the two kinds of equipment and the method of treatment; for temperatures above 25–26°C. [77–78·8°F.], the exposure period is reduced to 45 minutes. Effective preventive measures comprise the destruction of fallen nuts and of unripe nuts produced between crops, the frequent application of lime-wash to storehouses and, if possible, treatment of the walls with an emulsified solution of DDT or γ BHC, and, in the packing sheds, the replacement of the earthen floors by cement ones and the destruction of all débris from the nuts and packing materials.

Mallamaire (A.). **Les insectes nuisibles au poisson seche en Afrique. Moyens de les combattre.**—*Bull. Prot. Vég. A.O.F.* 1956–57 pp. 89–99, 12 figs., 5 refs. Dakar, 1958.

Dried and salted or smoked fish is an important article of commerce in West Africa, but is often attacked by insects, which sometimes cause serious losses in storehouses and during transport. Among the commonest and most injurious are *Dermestes frischii* Kug., *D. maculatus* Deg. and *Necrobia rufipes* (Deg.) [*cf.* also *R.A.E.*, A **44** 423; **47** 467]. Females of *Dermestes* oviposit over several months, laying 250–300 eggs each, in groups of 2–10 in crevices in the fish and in existing larval galleries, and the larvae mine irregularly in the superficial layers, but penetrate deeper for pupation. Larval development lasts 5–8 weeks, including a prepupal stage of about two weeks, and the pupal stage lasts 8–10 days. Adults and larvae are present throughout the year, but infestation increases considerably during the rains, between the end of July and the end of October. *D. frischii* is most frequent on sea fish, particularly at Saint Louis and Dakar, in Senegal, and *D. maculatus* on freshwater fish, especially at Mopti, in the French Sudan. *N. rufipes* is particularly abundant in Senegal on dried and salted sea fish. The females lay up to 2,000 eggs each in crevices and wrinkles in the fish, the larvae hatch in 4–5 days and become fully fed in 25–35 days, and development is completed in 2–3 months. There are several overlapping generations a year.

Attempts at control in Senegal by using infra-red radiation to ensure that the fish was thoroughly dried proved unsuccessful because of insufficient penetration at doses that did not injure the surface. The recommended control measure is therefore fumigation with methyl bromide at 80–100 or ethylene oxide at 150 oz. per 1,000 cu. ft. for two hours, which kills all the insects present and does not harm the fish. If the fish is to be stored, it should be fumigated at the beginning of the storage period and again before shipment. Packing materials should be soaked in DDT and the outside of the packages dusted with DDT or γ BHC (lindane) at about 0·3 oz. per sq. yd. A proposed fumigation plant for erection at Mopti is described.

Mallamaire (A.) & Roy (J.). **La lutte contre le criquet pèlerin** (*Schistocerca gregaria* **Forsk.) en Afrique occidentale française.**—*Bull. Prot. Vég. A.O.F.* 1958, 113 [+1] pp., 8 col. pls., 55 figs., 10 maps (2 col., 4 fldg.). Dakar, 1959.

This bulletin on *Schistocerca gregaria* (Forsk.) and its control in French West Africa contains information on the life-cycle, phases and seasonal breeding and migration of the locust and on the losses caused by it, with descriptions of all stages, an account of the invasion of the northern territories in 1956 by an unusually large number of swarms from the east combined with unusual migration from Mauritania and northern French Sudan following failure of the rains there and of the subsequent breeding up to May 1958, descriptions of the system adopted for reporting the movements of the locust, the organisation of control and the control techniques, and an account of the campaigns carried out in 1956–58.

The insecticides used included a dust of 25 per cent. technical BHC in finely ground natural phosphates, which gave good control when applied from small bags against the newly hatched hoppers at rates of about 13·5–22·5 lb. per acre, by hand-operated or power equipment at a rate

of about 13·5 lb. per acre, from aircraft at rates of about 6·3–9 lb. per acre, and also as a wet bait at a concentration of 6 per cent. in a carrier of groundnut débris; the bait was used at about 45 lb. per acre in groundnut fields attacked by second-instar hoppers and gave complete control. In general, dusts are superior to baits, owing to the dense plant cover and the difficulty of transporting a large labour force over the distances involved. A spray of 10 per cent. γ BHC in gas-oil, used on a large scale in 1957 at about 3½ pints per acre, gave excellent control of hopper bands and of resting and flying swarms. Dieldrin at 2·5 per cent. in gas-oil was also used at the same rate on a large scale in 1957, when it was the principal material applied from aircraft against hopper bands; furthermore, it completely destroyed swarms that alighted on shrubs to which it had been applied a month earlier against hoppers.

A campaign during the winter of 1956–57 against flying swarms in Senegal markedly reduced the breeding areas from which the French Sudan was later invaded. In another in Mauritania in the spring against hopper bands that resulted from breeding by the immigrant swarms from East Africa, advantage was taken of the persistent effect of dieldrin to increase the area effectively treated by a given dosage by applying the spray in bands perpendicular to the line of march of the hoppers; excellent control was obtained, and the risk of spread to Senegal in May and June averted. During the summer, campaigns against hoppers and adults were carried out in Mauritania and in the French Sudan (where only small-scale operations were necessary), against hopper bands in Niger, and, on a large scale, against ovipositing females, hoppers and young adults in Senegal, where most crops were successfully protected from damage. A further successful campaign was carried out by aircraft against migrating swarms of young adults in Senegal during the winter of 1957–58. From the results obtained during the period under review, it is concluded that the use of aircraft offers considerable promise for future campaigns against both hoppers and flying swarms.

Rodrigues (M. da C.). **Os ácaros na cultura algodoeira em Moçambique. O *Tetranychus* sp. aff. *truncatus* Ehara e alguns dos seus inimigos naturais.** [The mites on cotton in Mozambique. *Tetranychus* sp. aff. *truncatus* and some of its natural enemies.]—*Garcia de Orta* **7** no. 4 pp. 715–740, 10 pls. (3 col.), 7 figs., 14 refs. Lisbon, 1959. (With a summary in English.)

An outbreak of a species of *Tetranychus* identified as close to *T. truncatus* Ehara occurred in Mozambique in 1955 on cotton that had received frequent and excessive treatments with DDT. A survey of the mites on cotton and a study of this one in particular were subsequently undertaken. Mites of six families were found, including three other Tetranychids, of which *Oligonychus coffeae* (Nietn.) was the only one identified to species, but they were of little or no importance. All stages of the species close to *T. truncatus* are described, notes on its habits are given, and it is stated that it also infests cassava (*Manihot esculenta* (*utilissima*)), castor (*Ricinus communis*), beans (*Phaseolus* sp.), certain garden plants and wild grasses. It lives on the lower surfaces of the leaves, causing spotting and sometimes defoliation, though this occurred only on cassava and castor. Infestation of cotton began in the first week of growth and reached a peak within a month, after which it declined. Natural enemies of the mite included a species of *Typhlodromus* and numerous predacious insects, and notes on the morphology and habits of them are given.

Toms (A. M.). **Some recent trends in cotton yields in the Sudan Gezira with special reference to the response to spraying with DDT against Jassid.**—*Emp. Cott. Gr. Rev.* **36** no. 1 pp. 5–11, 1 graph, 3 refs. London, 1959.

The following is based on the author's summary. Recent trends in cotton yields in the Sudan Gezira are discussed in the light of experiments [*cf. R.A.E.*, A **48** 53]. From the data available, there appears to be a large difference in response to DDT sprays, even at the same site, between cottons of the Sakel type (represented by Domains Sakel) and cottons of the L type (represented mainly by X 1730A), which were derived from the former and introduced in 1936 because of their resistance to leaf-curl. The main insect controlled by DDT is *Empoasca lybica* (de Berg.). Most of the elimination of the yield difference between the two types that was present before the introduction of nitrogenous fertilisers and DDT spraying is due to this difference in response. It is therefore suggested that cotton of the L type is not as susceptible to damage by *E. lybica* as cotton of the Sakel type.

Common (I. F. B.) & Arndt (W.). *Tonica effractella* (**Snellen**) (**Lepidoptera: Oecophoridae**) **as a pest of cotton in Northern Australia.**—*Emp. Cott. Gr. Rev.* **36** no. 1 pp. 28–31, 2 pls., 1 fig., 8 refs. London, 1959.

The following is based on the authors' abstract. In 1957–58, larvae of the indigenous *Tonica effractella* (Sn.) damaged non-irrigated cotton in the Northern Territory of Australia by tunnelling and feeding in the main stems. The damage caused by the Oecophorid is discussed, and characters distinguishing it from related species and other cotton pests are described.

Outbreaks and new records.—*FAO Plant Prot. Bull.* **8** no. 6 pp. 70–71, 1 fig., 2 refs. Rome, 1960.

G. H. Berg reports (p. 70) that although the *Citrus* blackfly, *Aleurocanthus woglumi* Ashby, is known to be present in Mexico and in Costa Rica, its distribution in other countries of Central America is obscure. It was recently collected in Nicaragua on *Citrus* in a garden in Managua, where individual leaves were heavily infested, and light infestations were also observed on the leaves of sweet orange near San Marcos.

I. A. Ibrahim & M. K. Abo-el-Dahab report (p. 71) that symptoms of leaf-curl disease were observed for the first time in Egypt on certain varieties of long-staple Egyptian cotton in an experimental field at Kafr El-Dawar in 1957. In 1958, the disease appeared in almost all the cotton fields of Behera Province. The symptoms, which are described, were typical for the disease as known in the Sudan and Nigeria. The known vectors of the virus, whiteflies of the genus *Bemisia* [*B. tabaci* (Gennadius)], are stated not to have been reported in Egypt [but *cf. R.A.E.*, A **22** 678].

Lean (O. B.). **Annual and monthly frequencies of desert locust infestations.**—*FAO Plant Prot. Bull.* **8** no. 7 pp. 82–85, 3 graphs, 1 fldg. table, 2 refs. Rome, 1960.

The author gives a table showing the countries and months in which swarms or hopper bands of *Schistocerca gregaria* (Forsk.) were reported in

1949–59 and graphs on which the numbers of territory-months are plotted against years, breeding and total activity (also in territory-months) against months for the whole period, and territory-months against months for 1951–52 and 1955–56. The trends thus indicated lack mathematical significance, but illustrate the rapidity with which locust activity may increase after a period of quiescence, a lower level of activity during the third quarter of the year, and the interdependence of infestations within the total invasion region.

Rosenthal (I.), Gordon (C. F.) & Stanley (E. L.). **Microdetermination of TDE in spray residues.**—*J. agric. Fd Chem.* **7** no. 7 pp. 486–488, 1 fig., 9 refs. Easton, Pa., 1959.

The following is based on the authors' summary. A method is described for the determination of DDD (1,1-di(p-chlorophenyl)-2,2-dichloroethane) as a residue in plant extracts. After partial purification by solvent partitioning and treatment with adsorbent, the residue is dehydrohalogenated to 1,1-di(p-chlorophenyl)-2-chloroethylene in a rapid selective manner by the use of sodium ethylate in dimethylformamide. Treatment of this alkene with sulphuric acid yields a coloured carbonium ion complex, with a maximum absorption at 502 mμ. Extraction and cleaning procedures are described, with a discussion of the method, which can detect as little DDD as 0·07 part per million in a 15-g. sample.

Frehse (H.) & Tietz (H.). **Quantitative determination of arsenic residues in plant materials.**—*J. agric. Fd Chem.* **7** no. 8 pp. 553–558, 3 graphs, 21 refs. Easton, Pa., 1959.

The following is based on the authors' summary. A total analytical method is presented for the microdetermination of arsenic in plant material as finally measured by means of the molybdenum blue reaction. The procedure is based on a wet-ashing process of the material to be analysed, followed by distillation in special apparatus. From 1 to 60 μg. of arsenic per sample can be determined by direct reading from a single standard curve, and such curves are given for standard and distilled sodium arsenate and a proprietary compound. The method is especially valuable for determination of arsenic residues in any crop after pre-harvest treatment with arsenical compounds.

Skraba (W. J.) & Young (F. G.). **Radioactive Sevin (1-naphthyl-1-carbon-14 N-methylcarbamate), a convenient synthesis.**—*J. agric. Fd Chem.* **7** no. 9 pp. 612–613, 5 refs. Easton, Pa., 1959.

Miskus (R.), Gordon (H. T.) & George (D. A.). **Colorimetric determination of 1-naphthyl N-methylcarbamate in agricultural crops.**—*T.c.* pp. 613–614, 2 refs.

A convenient method for synthesising Sevin labelled with radioactive carbon (^{14}C) at position 1 of the ring is described in the first paper, and a colorimetric method of determining Sevin residues in plant tissues, sensitive to 5–40 μg., in the second.

Fairchild (H. E.). **"Sesoxane" as a synergist for methoxychlor.**—*Soap & chem. Spec.* **34** no. 1 pp. 82, 84, 151, 4 refs. New York, N.Y., 1958.

The results are given of preliminary laboratory experiments with sesamex (Sesoxane) as a synergist for methoxy-DDT (methoxychlor) in acetone sprays applied to six species of insects and a mite. Against adults of *Tribolium confusum* Duv., *Sitophilus granarius* (L.) and *Musca domestica* L., larvae of *Attagenus megatoma* (F.) (*piceus* (Ol.)) and nymphs of *Blattella germanica* (L.), the spray was delivered downwards from an aspirator sprayer on to the insects in open dishes or screen-topped cages on a moving conveyor, at a rate of about 5 mg. liquid per sq. cm. A similar sprayer mounted over a turntable platform revolving 3·3 times a minute was used to deliver 50 ml. spray per 0·62–0·64 minute on to mixed adult and nymphal populations of *Aphis fabae* Scop. and *Tetranychus telarius* (L.) on leaves. The addition of an equal amount of sesamex raised the kill of *Tribolium* adults effected by 0·25 per cent. methoxy-DDT in 24 hours from 30 to 75 per cent. and that of larvae of *Attagenus* effected by 1 per cent. methoxy-DDT from 20 to 58·3 per cent. Sesamex alone was not toxic to these species. In the case of *S. granarius*, the mortality percentages for methoxy-DDT and sesamex alone at 1 per cent. and the two together at 1 per cent. of each were 1·7, 41·7 and 98·3, respectively. A spray containing 0·5 per cent. sesamex and 1 per cent. methoxy-DDT gave complete kill of the aphid and mite in 20 hours, and the kills of both species were several times as high as the sums of the kills effected by the ingredients separately. Similar results were obtained with *M. domestica* and *B. germanica* [*cf. R.A.E.*, B **48** 175].

Monro (H. A. U.). **The response of *Tenebroides mauritanicus* (L.) and *Tenebrio molitor* L. to methyl bromide at reduced pressures.**—*J. Sci. Fd Agric.* **10** no. 7 pp. 366–379, 6 graphs, 28 refs. London, 1959.

The following is based on the author's summary. The responses of larvae and adults of *Tenebroides mauritanicus* (L.) to fumigation with methyl bromide at reduced pressures were complex. At pressures of 15–30 mm. mercury, high mortalities were due more to desiccation than to the fumigant. At 30–50 mm., low mortalities occurred, though there was loss of visible activity. At 50–175 mm., increased activity and high mortalities were observed. From 175 mm. to atmospheric pressure, activity was normal and mortality declined. In the second and last of these ranges, the responses were independent of humidity. Larvae of *Tenebrio molitor* L. gave responses similar to the last three, but at different pressure ranges.

Thompson (C. C.). **The determination of fluoroacetic acid and fluoroacetamide in plant material.**—*J. Sci. Fd Agric.* **10** no. 7 pp. 388–394, 1 graph, 28 refs. London, 1959.

The following is virtually the author's summary. An analytical method is described for the determination of total organically combined fluorine in a mixture of fluoroacetamide and fluoroacetic acid in plant material; a method is also suggested for the determination of fluoroacetamide alone. On a 100-g. sample of plant material, 1 part per million can be determined with an accuracy of 13 per cent. and 0·1 p.p.m. with an accuracy of 50 per cent. The methods involve the determination of the fluorine content of plant extracts and therefore depend for their validity on the removal of interfering fluorine-containing plant constituents.

Furmidge (C. G. L.). **Physico-chemical studies on agricultural sprays. III. Variation of phytotoxicity with the chemical structure of surface-active agents.**—*J. Sci. Fd Agric.* **10** no. 8 pp. 419–425, 6 refs. London, 1959.

The following is virtually the author's summary of this third part of a series [*cf. R.A.E.*, A **48** 332]. The phytotoxicity and wetting ability of 61 surface-active agents of known chemical structure were tested on the leaves of two varieties of apple and two of plum. Surface-active materials containing a branched alkyl chain in the hydrophobic portion of their molecule were better wetters than corresponding materials containing a straight alkyl chain. In any homologous series of materials, wetting ability increased with increase in size of the alkyl group. With the non-ionic ethylene oxide condensates, maximum wetting occurred with those materials containing the minimum number of ethylene oxide groups conferring water solubility.

Phytotoxicity appeared to be governed by the nature of the ionic charge, by the physical size of the molecules or ions and to a lesser extent by the nature of the gegenion. All non-ionic materials caused little damage on apple and plum leaves, anionic and cationic materials caused variable damage, depending on their chemical structure and on the nature of the leaf surface. In any homologous series of surface-active agents, the phytotoxicity appeared to pass through a maximum as the molecular size was progressively increased. Since this maximum usually occurred at fairly short alkyl chain lengths (dodecyl or below), for most practical purposes phytotoxicity decreases as the size of the alkyl group increases.

These results are discussed in the light of the conclusions reached in the second part of this series [*cf. loc. cit.*], and the physical and chemical factors governing phytotoxicity are considered.

Pschorn-Walcher (H.) & Zwölfer (H.). **Preliminary investigations on the *Dreyfusia* (*Adelges*) populations living on the trunk of the silver fir.**—*Z. angew. Ent.* **42** pt. 3 pp. 241–277, 12 figs., 46 refs. Hamburg, 1958. (With a summary in German.)

The authors review the classification of the species and forms of *Chermes* (*Dreyfusia*) that commonly infest fir (*Abies*) in Europe and Canada, with information concerned largely with their differential characters, life-cycles, distribution, habitats on the tree and economic importance [*cf. R.A.E.*, A **48** 271–272, etc.], and describe detailed investigations carried out in stands of silver fir (*A. alba*) in eastern Switzerland and the Vosges mountains of France in 1954–56 on the fluctuations in population of the trunk-infesting *C. nordmannianae* Eckstein (*D. nüsslini* Börn.) form *schneideri* (Börn.) and *C.* (*D.*) *piceae* Ratz. form *typica*. The following is based on their summary of the results.

Observations in 27 stands in which infestation was low (endemic) showed that nearly all the older firs had at least some local infestation and that there was a positive correlation between the density of the colonies and the percentage of trunks infested. Light, dry forest had less infestation than dense, damp forest, and beech-fir forest less than purely coniferous stands. The endemic population fell by 94–99 per cent. during the severe winter of 1955–56. Investigations on the causes of mass increase in population (mainly of *C. nordmannianae* form *schneideri*) showed that artificial infestation of a caged section of trunk with 1,000 eggs gave rise to local mass infestation after 2–3 generations, high population density

no doubt favouring rapid increase in population owing to the activation of bark protein and the resulting increased food value of the bark [*cf.* **48** 271], and adults in massed colonies laid more eggs than those in endemic populations, possibly for the same reason. Developing hiemosistentes suffered considerable mortality from overcrowding during the early spring of 1955, and the bark capacity was found to be limited to about 200–250 adults per sq. in. Neosistentes of the new generation also suffered high mortality, and this had risen to 50–75 per cent. by the beginning of the winter of 1955–56, but the population was nevertheless still considerable at that time on about half the trees, after which frost almost totally destroyed the population. Trunks on which an outbreak had ended in the previous year could not be artificially infested so readily as trunks having a current outbreak or an endemic infestation, evidently owing to bark degeneration [*cf.* **48** 271], and insects taken at the collapse of an outbreak were the least able to become re-established, evidently owing to decreased vitality caused by feeding on degenerated bark. These factors are considered to be of greater importance in their effect on changes in population density than are natural enemies, the effect of which has probably been exaggerated.

EICHHORN (O.). **Morphologische und papierchromatographische Untersuchungen zur Artentrennung in der Gattung *Dreyfusia* C.B. (Adelgidae).** [Morphological and paper-chromatographic investigations on the classification of species of the genus *Chermes*.]—*Z. angew. Ent.* **42** pt. 3 pp. 278–283, 1 col. pl., 2 figs., 13 refs. Hamburg, 1958. (With a summary in English.)

Further morphological investigations confirmed the existence of three species of *Chermes* (*Dreyfusia*) commonly infesting silver fir (*Abies alba*) in Europe [*cf. R.A.E.*, A **48** 271–272], *C.* (*D.*) *piceae* Ratz., *C. nordmannianae* Eckstein (*D. nüsslini* Börn.) and *C.* (*D.*) *merkeri* (Eichhorn), and the results were strongly supported by paper-chromatographic studies of their various stages and of those of *C.* (*D.*) *prelli* (Grosmann), which mostly infests *A. nordmanniana*.

MÜLLER (H.). **Zur Kenntnis der Schäden, die Lachniden an ihren Wirtsbäumen hervorrufen können.** [On the damage that Lachnids may cause to their host trees.]—*Z. angew. Ent.* **42** pt. 3 pp. 284–291, 1 fig., 12 refs. Hamburg, 1958. (With a summary in English.)

High populations of wood ants [*Formica rufa* L.] are effective in protecting forests against caterpillars and sawfly larvae in Germany [*cf. R.A.E.*, A **48** 156, etc.] but favour Lachnines, particularly on beech, which may be damaged by the resulting mass increase.

JANISCH (E.). **Nachträge zum Problem des Polyedervirus bei Insektenkrankheiten.** [Supplementary remarks on the problem of polyhedral viruses in insect diseases.]—*Z. angew. Ent.* **42** pt. 3 pp. 292–306, 4 figs., 44 refs. Hamburg, 1958. (With a summary in English.)

The history of research into the nature of polyhedral viruses in insects is reviewed and the results of investigations begun during the late war on polyhedral viruses in *Bombyx mori* (L.) and *Lymantria monacha* (L.) are recorded. The following is based on the author's summary of them. The polyhedra consisted of non-infective polyhedral protein of low molecular

weight and an infective polyhedral virus of high molecular weight. The structure of the polyhedra and their formation in the cell nuclei, as observed by phase contrast microscopy, confirmed these results. The polyhedra are dissolved in the pupal haemolymph and the virus penetrates the terminal cells of the ovaries, producing a latent infection in the progeny that becomes acute under adverse environmental conditions and with constitutional weakening of the insect.

Schefer-Immel (V.). **Einige Bemerkungen zur Biologie und zum Einfluss von Temperatur und rel. Luftfeuchtigkeit auf die Entwicklung von Ei, Raupe und Puppe von** *Boarmia bistortata* **Goeze (Lepidoptera, Geometridae).** [Observations on the bionomics of *B. bistortata* and the influence of temperature and relative humidity on the development of the egg, larva and pupa.]—*Z. angew. Ent.* **42** pt. 3 pp. 307–315, 1 graph, 12 refs. Hamburg, 1958. (With a summary in English.)

In connection with an outbreak of *Boarmia bistortata* (Goeze) on larch [*Larix leptolepis*] in Schleswig Holstein [*cf. R.A.E.*, A **47** 103], the Geometrid was reared in the laboratory in 1955–56 from pupae collected in the autumn of 1955. The egg and five larval instars are described. The larvae preferred the needles of larch to needles or leaves of various other plants and attained a greater size when feeding on them. Their food requirements were great, each larva destroying up to 10–12 short shoots while in the last two instars alone. Differences in relative humidity between about 30 and 100 per cent. had little effect on the duration of development, but the percentage of individuals surviving was much greater at relative humidities of about 70–100 per cent. than at about 30–55 per cent. Larvae kept at 17 per cent. relative humidity did not develop beyond the second instar. At 70–100 per cent. relative humidity, development from egg to adult was completed in 79 days at 18°C. [64·4°F.], 56 days at 20°C. [68°F.], 40 days at 25°C. [77°F.] and 46 days at 27°C. [80·6°F.]; it was not completed at 29°C. [84·2°F.]. At 25°C., the egg, larval and pupal stages lasted 6, 21 and 13 days, respectively. In view of the high optimum relative humidity and the temperature requirements of *B. bistortata*, an oceanic climate seems most suited to outbreaks.

Heddergott (H.). **Der gegenwärtige Stand der Bekämpfung von Baumwollschädlingen in Ägypten.** [The present position in the control of cotton pests in Egypt.]—*Z. angew. Ent.* **42** pt. 3 pp. 334–350, 31 refs. Hamburg, 1958. (With a summary in English.)

The author reviews the bionomics of the chief pests of cotton in Egypt, the damage that they cause, the organisation of control measures and the cultural, mechanical and chemical methods used, including a survey of the insecticides tested.

Gersdorf (E.). **Zum Auftreten des Maikäfers in Niedersachsen.** [On the occurrence of *Melolontha* in Lower Saxony.]—*Z. angew. Ent.* **42** pt. 4 pp. 401–408, 1 map, 5 refs. Hamburg, 1958. (With a summary in English.)

The distribution and flight years of *Melolontha melolontha* (L.) and *M. hippocastani* F. in Lower Saxony are reviewed [*cf. R.A.E.*, A **48** 161], and the factors responsible, notably climate, are discussed.

Herfs (A.). **Insektenschäden an Knöpfen.** [Insect damage to buttons.]—*Z. angew. Ent.* **42** pt. 4 pp. 420–428, 12 figs., 13 refs. Hamburg, 1958. (With a summary in English.)

The author reviews from his own experience the damage caused by insects to buttons. The Scolytid, *Coccotrypes dactyliperda* (F.), which normally develops in the seeds of palms, infests buttons made of ivory nuts (*Hyphaene* and *Phytelephas*), *Anthrenus fasciatus* (Hbst.) destroys buttons made of horn, and *Gibbium psylloides* (Czenp.) injures plastic buttons. To reduce the damage, infested raw material should be destroyed and storehouses fumigated.

Hagedorn (D. J.), Bos (L.) & van der Want (J. P. H.). **The red clover vein-mosaic virus in the Netherlands.**—*Tijdschr. PlZiekt.* **65** pt. 1 pp. 13–23, 4 pls., 1 graph, 15 refs. Wageningen, 1959. (With a summary in Dutch.)

In the course of this paper on the virus of red-clover vein-mosaic and pea stunt in Holland, where it has recently been observed on red and white clover (*Trifolium pratense* and *T. repens*) and peas, experiments are recorded showing that the virus was transmitted from infected to healthy pea plants by *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris) and *Myzus persicae* (Sulz.), but not by *Aphis fabae* Scop. The virus was of the non-persistent type.

Nijveldt (W.). **Over het gebruik van vangkegels bij het galmugonderzoek.** [On the use of conical traps in gall-midge investigations.]—*Tijdschr. PlZiekt.* **65** pt. 2 pp. 56–59, 1 fig., 3 refs. Wageningen, 1959. (With a summary in English.)

A conical trap of metal gauze and zinc strips, 14 in. in height, fixed to two zinc hoops, the upper one 2·5 and the lower one 11 in. in diameter, standing on four short legs and with a collecting jar fitted with a small plastic entrance cone attached to the top, has proved useful for observations on the dates of emergence of Cecidomyiids of several species in Holland. Full details are given.

Hulshoff (A. J. A.). **Een nieuwe galmug in Nederland: *Haplodiplosis equestris* (Wagner).** [A new gall-midge in Holland: *H. equestris*.]—*Landbouwvoorlichting* **16** no. 12 pp. 707–713, 1 fig., 3 refs. The Hague, 1959.

Haplodiplosis equestris (Wagn.), which had not previously been recorded from Holland, was discovered there on wheat and barley in 1958 and was found at several localities in the south-east of the country in the following year. Damage was caused by the stem-galls induced and by secondary disease invasion. The bionomics of the Cecidomyiid are described from studies carried out in 1959. The percentage of wheat stems attacked at one place was reduced from 64·5 in untreated plots to 8·5 by a spray of 0·25 per cent. DDT applied in mid-May (when the first adults emerged) followed 14 days later by one of 0·25 per cent. DDT with 0·125 per cent. parathion, both at 180 gal. per acre. Other treatments were considerably less effective.

Tinsley (T. W.). **Pea leaf roll, a new virus disease of legumes in England.** —*Plant Path.* **8** no. 1 pp. 17–18, 1 pl., 7 refs. London, 1959.

Broad beans (*Vicia faba*) affected with chlorosis and rolling of the upper leaves characteristic of the leaf-roll virus disease of peas were observed at Rothamsted in 1955, and the disease, which is known from Germany, Holland and Belgium [*cf. R.A.E.*, A **46** 330] but had not previously been noted in England, was observed in many crops of field beans and peas in south-eastern England in 1956 and 1957. Preliminary attempts to transmit the virus by means of sap inoculation or by *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) that had fed for a short time on infected plants were unsuccessful, but both *M. pisum* and, less frequently, *Myzus persicae* (Sulz.) transmitted it in 1956 after feeding for three days on infected field beans and for two on test plants (pea and broad bean) raised under glass; when ten aphids were used per test plant, about 30 per cent. of the plants in glasshouse experiments and 90 per cent. in field cages became infected. In 1956, disease incidence in field beans growing near lucerne decreased as the distance from the lucerne increased. The symptoms on field and broad beans comprise stunting, defoliation, a bright yellow coloration of the upper leaves, which become thickened, brittle and rolled, and necrosis of the growing points. The symptoms in peas are similar but less severe. In the glasshouse, broad beans develop green vein-banding and peas a transient chlorosis, though infected plants are always severely stunted. From samples collected in three bean fields in 1956, infection was estimated to reduce yield by about 50 per cent., chiefly by reducing the number of pods formed, though the beans were also slightly reduced in size. Infected bean plants were first seen on 4th July in that year, and 5 per cent. showed symptoms by the end of the month, when counts ceased; in a crop near Cambridge in which they were continued until mid-August, 20 per cent. of the plants became infected and the proportion was still probably increasing.

French (N.). **Control of the gooseberry red spider mite on gooseberry.**—*Plant Path.* **8** no. 2 pp. 45–46, 6 refs. London, 1959.

The following is based almost entirely on the author's summary. Excellent control of the form of *Bryobia practiosa* Koch [*sens. lat.*] that attacks gooseberry was obtained for the entire season in northern England in 1957 with an emulsion spray of DNC in oil applied in early March. Spring sprays of other materials gave adequate control, but for maximum protection they should be applied as early as possible after the winter eggs have hatched.

Bardner (R.). **Insecticidal control of wheat bulb fly larvae.**—*Plant Path.* **8** no 2 pp. 47–52, 8 refs. London, 1959.

The following is based on the author's discussion and summary. Seed dressings applied to wheat for the control of wireworms in England do not always prevent damage by *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) when used at the recommended rate of 2 oz. per bushel seed (0·08–0·04 per cent. toxicant to weight of seed), and attempts were therefore made in 1953–58 to discover improved methods of application. It is concluded from the results that insecticides applied at sowing time as seed dressings or combine-drill treatments may prove unnecessary, particularly on early sown wheat,

which usually has time to tiller before attack, and are effective mainly on late-sown or backward crops. Sprays applied during the period of larval attack were inferior to seed dressings or combine-drill treatments, because young plants have little foliage to which the spray can adhere and are difficult to wet, though this can be partly overcome by the addition of large quantities of a wetting agent or adhesive. Of those tested, 0·05–0·1 per cent. parathion applied at a rate of 100 gal. per acre was the cheapest and most effective, and such sprays may be of value on crops that would otherwise have to be redrilled. Broadcast treatments with a dieldrin dust at 5 lb. active ingredient per acre made just before the onset of attack gave promising results. Of various treatments applied at sowing time, a 4 per cent. dieldrin dust combine-drilled with the seed to give 5 lb. dieldrin per acre was the one most extensively tested, and it gave good results. Recent unpublished work shows that aldrin at 2 lb. per acre is also satisfactory.

Soil insecticides are usually most effective when applied as seed dressings. In eastern England, aldrin and dieldrin combine-drilled at 1·5 lb. per acre gave reasonable control, but were less effective than when applied as seed dressings at either 0·15 or 1 per cent. of seed weight (0·29 and 1·92 lb. toxicant per acre). Seed dressings at the higher rate were only moderately superior to those at the lower, and both materials were slightly inferior to heptachlor at the same rates. In another trial, dressings at these rates appeared more effective than one of γ BHC at 0·08 per cent. of seed weight and provided the most satisfactory measure tested.

Wyatt (I. J.). **A new genus and species of Cecidomyiidae (Diptera) infesting mushrooms.**—*Proc. R. ent. Soc. Lond.* (B) **28** pt. 11–12 pp. 175–179, 11 figs., 11 refs. London, 1959.

A new genus, *Henria*, is erected for a Cecidomyiid here described as *H. psalliotae*, sp.n., from adult females reared in February 1958 from larvae found in mushroom compost in Cornwall. No males were obtained from either of the two samples of compost received. The larvae are paedogenetic and had almost completely destroyed the mushroom crop from which they were obtained. A key to the five Cecidomyiids now known to infest cultivated mushrooms in Britain is included [*cf. R.A.E.*, A **47** 269].

Osborne (P.). **Observations on the natural enemies of** *Meligethes aeneus* **(F.) and** *M. viridescens* **(F.) (Coleoptera: Nitidulidae).**—*Parasitology* **50** no. 1–2 pp. 91–110, 16 figs., 27 refs. London, 1960.

The author gives a list of the known insect parasites and predators of *Meligethes aeneus* (F.) and *M. viridescens* (F.), together with information on six Hymenopterous parasites of the larvae and a few other organisms found attacking the adults of these Nitidulids on charlock (*Sinapis arvensis*) in Scotland in 1955. The post-embryonic stages of most of the Hymenoptera are described. The only one that oviposited readily in captivity was *Cryptoserphus parvulus* (Nees), which attacked both hosts. Eggs were laid in larvae in the first two instars, and development was completed in 27–29 days. It is not known how many eggs were laid at a time, but only one parasite adult emerged per host.

Pussard (R.). **Biocénose des lavandes—2 tordeuses nuisibles aux abords des limites, altitudinales ou culturales, de l'aire de ces plantes.**—*C.R. Acad. Agric. Fr.* **44** no. 15 pp. 768–772, 8 refs. Paris, 1958.

Lavender in the south of France is damaged by *Cacoecimorpha* (*Archips*) *pronubana* (Hb.) and *Aphelia* (*Amelia*) *viburniana* (F.), the larvae of which feed on the leaves. Observations on their bionomics and natural enemies are recorded. Dusts of DDT and sprays of BHC or parathion give good control.

Bonnemaison (L.) & Bournier (A.). **Note préliminaire sur les thrips nuisibles au lin.**—*C.R. Acad. Agric. Fr.* **44** no. 16 pp. 828–831, 2 refs. Paris, 1958.

Flax in the north and west of France is damaged by *Thrips tabaci* Lind., *T. lini* Lad. and *T. angusticeps* Uzel. Notes on the habits and distribution of these thrips are given, together with an account of experiments on the control of the last two, which attack young plants, by means of seed treatments with systemic insecticides and field sprays and dusts, of which several proved effective.

Taksdal (G.). **Angrep av skjermplantetege** (*Lygus campestris* **L.**) **i gulrotfrøfelt fører til nedsett spireprosent og avling.** [Attack by *L. campestris* in carrot seed fields leads to reduced germination and yield.]—*Gartneryrket* no. 42 pp. 709–714, 4 figs., 8 refs. Oslo, 1959. (With a summary in English.)

The following is based on the author's summary. *Lygus campestris* (L.) was found injuring the developing seeds of a carrot seed crop in Norway in 1956; other plants were also infested. The umbels were attacked by both nymphs and adults, and destruction of the embryos in the seeds led to decreased yield, the reduction in germination amounting to 40 per cent. and the loss of yield to 50 per cent. in one test, though insufficient ripening as a result of the shortness of the Norwegian summer may have been responsible for some of the low germination; sprays of 0·25 per cent. DDT did not improve the latter, even when applied three times [*cf. R.A.E.*, A **48** 401].

Borg (Å.). **Investigations on the biology and control of timothy grass flies** *Amaurosoma armillatum* **Zett. and** *A. flavipes* **Fall. (Dipt. Cordyluridae).**—*Medd. Växtskyddsanst.* **11** no. 75 pp. 297–372, 33 figs., 41 refs. Stockholm, 1959. (With a summary in Swedish.) **Timotejflugorna och deras bekämpning.** [Timothy flies and their control.]—*Växtskyddsnotiser* **23** no. 2–3 pp. 19–23, 5 figs. Stockholm, 1959.

In the first of these papers, the various stages of *Amaurosoma armillatum* (Zett.) and *A. flavipes* (Fall.) are described, their distribution in Sweden and the world is reviewed, and observations on their bionomics and control [*cf. R.A.E.*, A **23** 494–496] are recorded. These flies are common pests of seed crops of timothy grass (*Phleum pratense*) in Sweden. The adults emerge in May, males somewhat before females, and the latter lay their eggs singly on the upper surfaces of the leaves about eight days later. The larvae hatch in about five days and feed on the flowering parts in the young

ears, destroying about 50 per cent. of the seeds. They become full-fed in about 15 days and pupate in the upper layers of the soil; the pupae overwinter. Several parasites were reared from the two species, the most important being *Scladerma lactum* Wlk. and *Ectilis semirugosa* (Hal.), which emerge from the puparia. In tests against the ovipositing females, sprays affording 0·54–0·72 lb. DDT per acre gave the best results. Parathion was less effective and lost its toxicity in six days, and BHC had no effect. Dusting with DDT from the air was less successful than applying a smaller quantity of the insecticide in a ground spray.

The second paper is a shortened account of substantially the same information.

Holm (C.) & Ekbom (P.). **The significance of the house longhorn beetle as a destroyer of buildings and its control.**—*Tied. Valt. tekn. Tutkimusl. Sar.* III no. 22, 47 pp., 22 figs., 21 refs. Helsinki, 1958.

The authors review the life-history and distribution of *Hylotrupes bajulus* (L.) and give an account of its occurrence in the Åland Islands [*cf. R.A.E.*, A **48** 201], where it has severely damaged timber buildings at one place, and in two islands off the south-west coast of Finland. The damage caused is described, and protective measures are discussed.

Lodos (N.). **Orta Anadoluda meyva ağaçlarında zarar yapan Curculionidae (hortumlu böcekler) türleri üzerinde sistematik araştırmalar.** [Systematic investigations on the Curculionids injurious to fruit trees in central Anatolia.]—*Ege Üniv. Zir. Fak. Yayın.* no. 29, v+76 pp., 53 figs., 47 refs. [Smyrna] 1960. (With summaries in English & French.)

Information on fruit cultivation in central Anatolia and on the morphology, anatomy, and bionomics of weevils is followed by a systematic review of the 16 species known to injure orchard trees there, with notes on their classification, synonymy, vernacular names, appearance, distribution in Turkey and the world, and the trees infested. Several of them are recorded for the first time from central Anatolia or from Turkey as a whole. A list of trees showing the species that attack them is appended.

Williams (J. R.). **Cane pests.**—*Rep. Mauritius Sug. Ind. Res. Inst. 1958* pp. 66–71, 2 pls., 2 figs. Port Louis [1959].

During 1958, *Elasmus zehntneri* Ferrière and *Rhaconotus scirpophagae* Wlkn. were received from India and released in small numbers in sugar-cane fields in Mauritius for trial as parasites of *Proceras sacchariphagus* Bojer. *Crambus malacellus* Dup., previously known in the island as an occasional pest of young maize and rice, attacked germinating virgin cane in June–July at one locality. The larva bores into a young shoot below soil level and covers the hole with a gallery of silk and soil particles attached to the shoot [*cf. R.A.E.*, A **17** 417]. When not feeding, it retires to its gallery. A localised infestation of young virgin cane at another locality by larvae of *Alissonotum piceum* (F.) occurred in December. This Dynastid has previously occurred in cane fields, but injury by the larvae has not apparently been recorded. Aldrin and chlordane were successfully used against larvae of *Clemora smithi* (Arr.) [*cf.* **47** 196], and furrow treatments at planting time are recommended, the insecticides being used in dust or emulsion

formulation. The introduced Mirid, *Tytthus mundulus* (Bredd.), which preys on *Perkinsiella saccharicida* Kirk. and other leafhoppers, is established in one locality [*cf.* **47** 196] and has spread somewhat.

GANGWERE (S. K.). **Experiments upon the food consumption of the grasshopper** *Melanoplus s. scudderi* **(Uhler).**—*Pap. Mich. Acad. Sci.* **44** pt. 1 (Nat. Sci.) pp. 93–96, 3 refs. Ann Arbor, Mich., 1959.

Tests were made on the food consumption of adult males and females of *Melanoplus scudderi scudderi* (Uhl.), and the following is based on the author's conclusions from the work. Food consumption in Orthoptera is known to increase in direct proportion to size during the nymphal stages. In adults, this direct relation between size and food consumption does not appear, except perhaps among different-sized individuals of the same sex. While females of a species eat more than males, they eat less per unit of weight, as would be expected from their lesser activity and lower metabolic rate. The consumption ratio between male and female is relatively constant, even under fluctuating environmental conditions, for changes in temperature and humidity alter gross consumption without affecting the ratio.

PAPERS NOTICED BY TITLE ONLY.

NORRIS (M. V.) & KUCHAR (E. J.). **Colorimetric estimation of malathion residues in cottonseed.**—*J. agric. Fd Chem.* **7** no. 7 pp. 488–489, 3 refs. Easton, Pa., 1959.

JOHNSON (B.). **Effect of parasitization by** *Aphidius platensis* **Brèthes on the developmental physiology of its host,** *Aphis craccivora* **Koch.**—*Ent. exp. appl.* **2** no. 2 pp. 82–99, 3 pls., 7 figs., 20 refs. Amsterdam, 1959. (With a summary in German.)

MARIANI (M.). **Dieci anni di ricerche sulla resistenza degli insetti agli insetticidi di sintesi. Rivista critica e repertorio bibliografico.** [Ten years of research on the resistance of insects to synthetic insecticides (largely DDT). A critical review and bibliography.]—*Atti Accad. Palermo* (4) **18** pt. 1 pp. 129–211, 1 pl., 590 refs. Palermo, 1959.

VAPPULA (N. A.). **Finnish entomological literature published in 1957, including** [titles of papers on] **economic entomology and control of insect pests.**—*Ann. ent. fenn.* **25** no. 4a 17 pp. Helsinki, 1959. [*Cf. R.A.E.*, A **48** 40.]

USINGER (R. L.) & WYGODZINSKY (P.). **Insects of Micronesia. Vol. 7 no. 5. Heteroptera: Enicocephalidae.**—pp. [3 +] 219–230, 4 figs., 1 map. WYGODZINSKY (P.) & USINGER (R. L.). **Heteroptera: Reduviidae.**—pp. [3 +] 231–283, 27 figs., 1 map. Honolulu, Bishop Mus., 1960. QUATE (L. W.). **Vol. 13 no. 3. Diptera: Empididae.**—pp. [3 +] 55–73, 6 figs., 1 map. 1960. [*Cf. R.A.E.*, A **43** 345; **47** 236.]

STORWASSER (H.). **Untersuchung über quantitative Bestimmungsverfahren kleiner Mengen von Pflanzenschutzwirkstoffen nach ihrer Ausbringung besonders in Aerosolform.** [Investigations on quantitative determination of small quantities of plant-protection chemicals after application particularly in aerosol form (a survey of methods applicable to insecticides and fungicides).]—*Z. PflKrankh.* **66** pt. 1 pp. 1–15, 1 graph. Stuttgart, 1959. (With a summary in English.)

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